THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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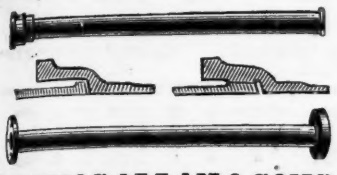

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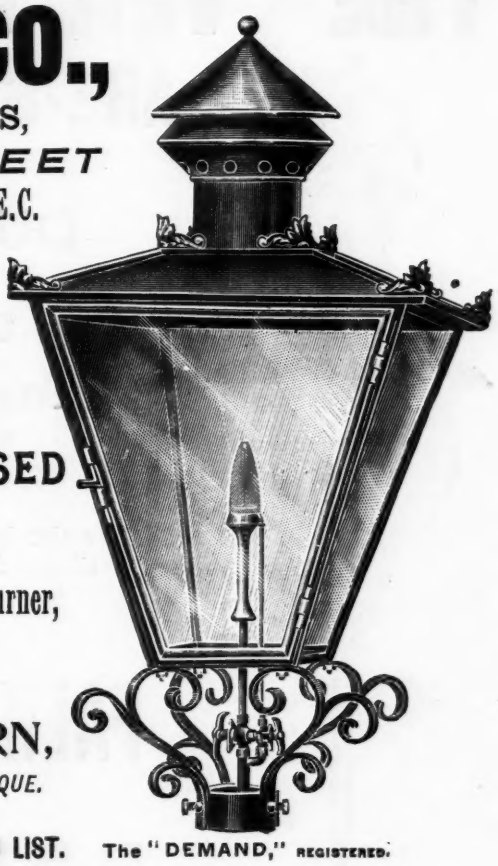

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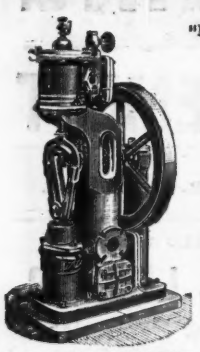

Fig. 705. "SINGLE RAM" STEAM-PUMP.

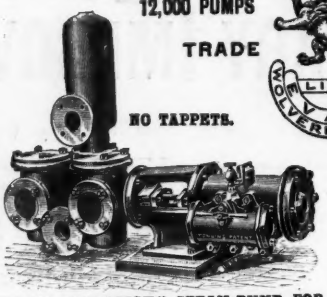

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

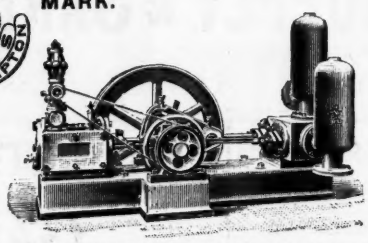

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

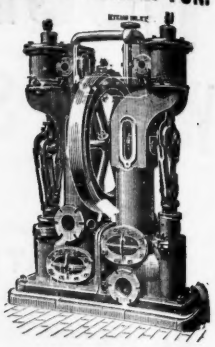

Fig. 712 "DOUBLE-RAM" STEAM-PUMP.

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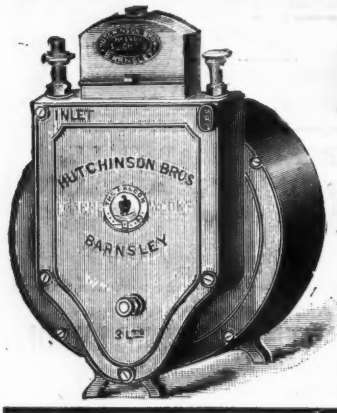

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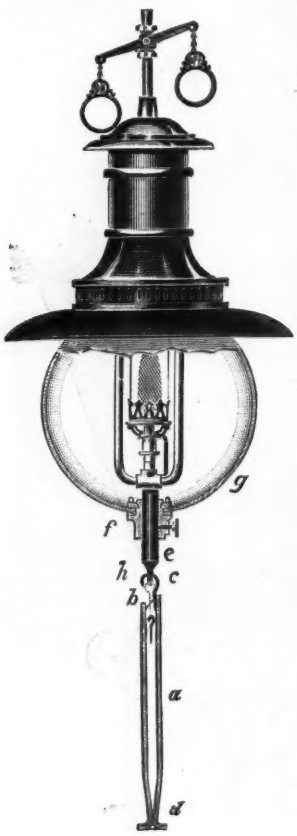

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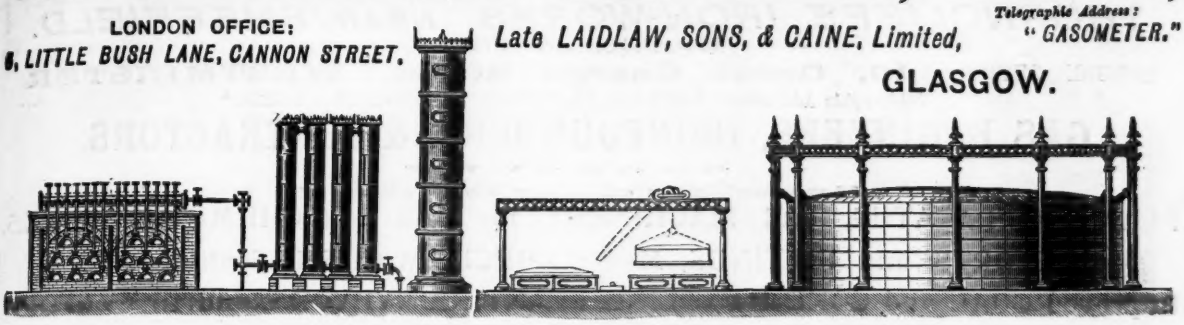

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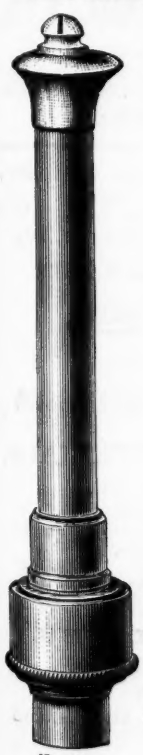

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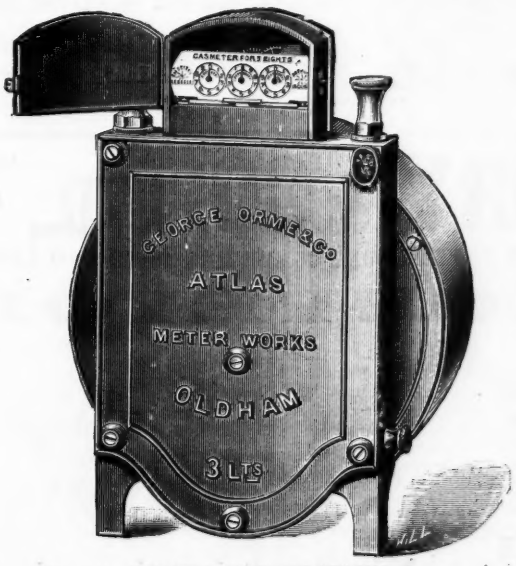
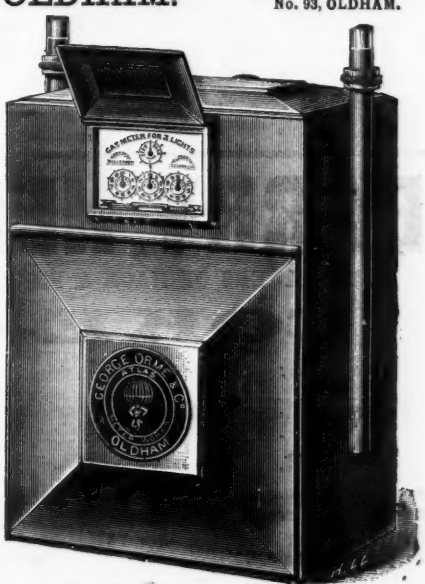


WET GAS-METER IN CAST-IRON CASE.



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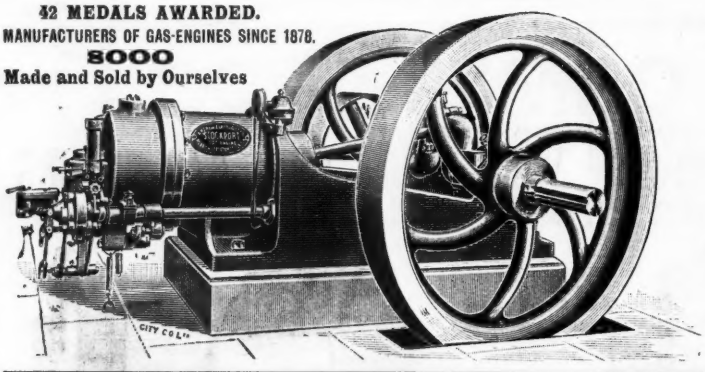

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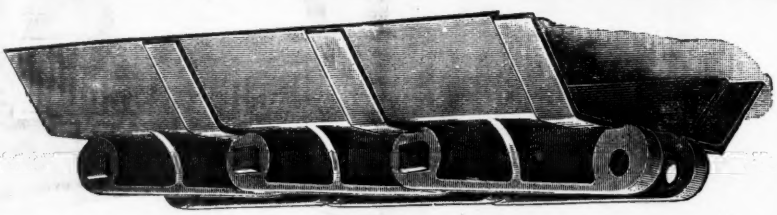

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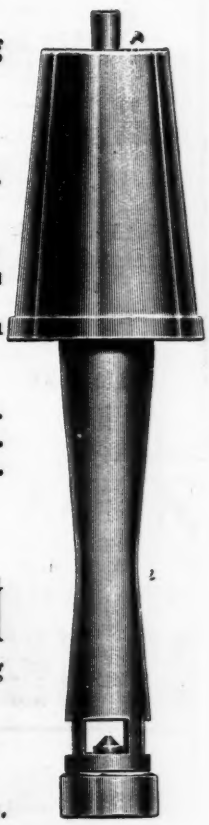

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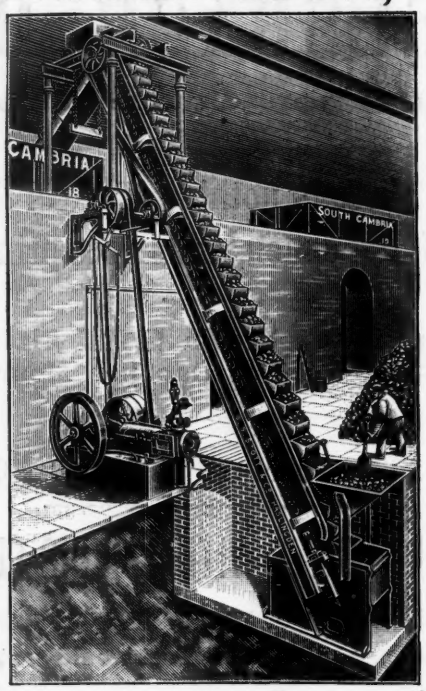

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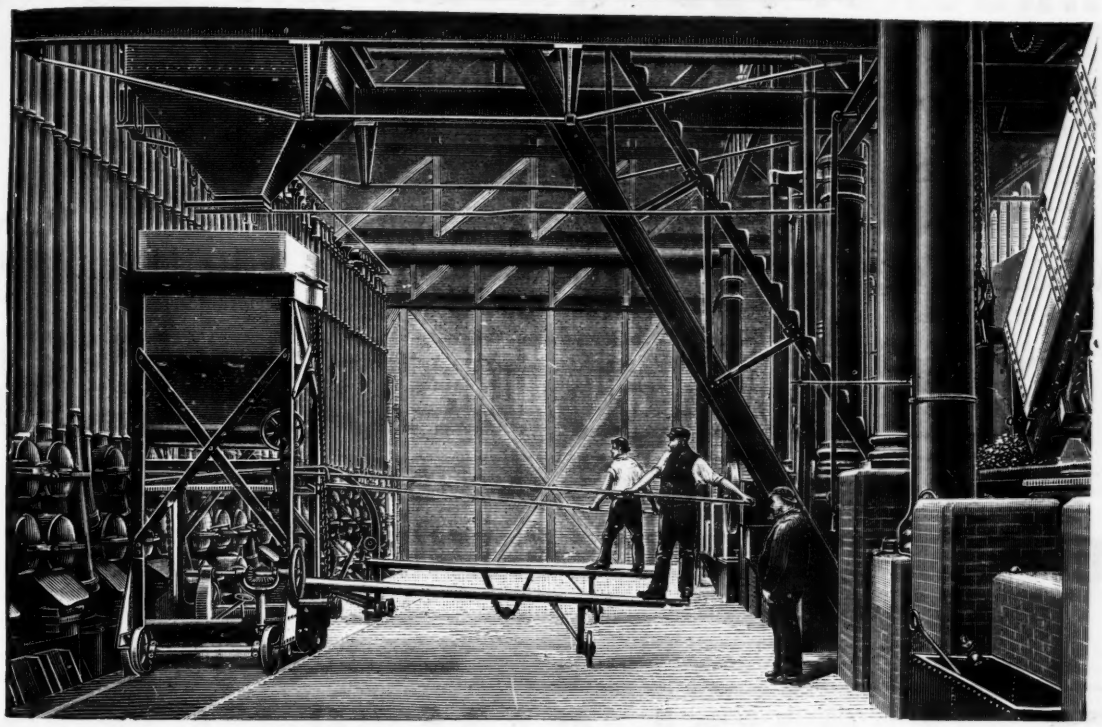

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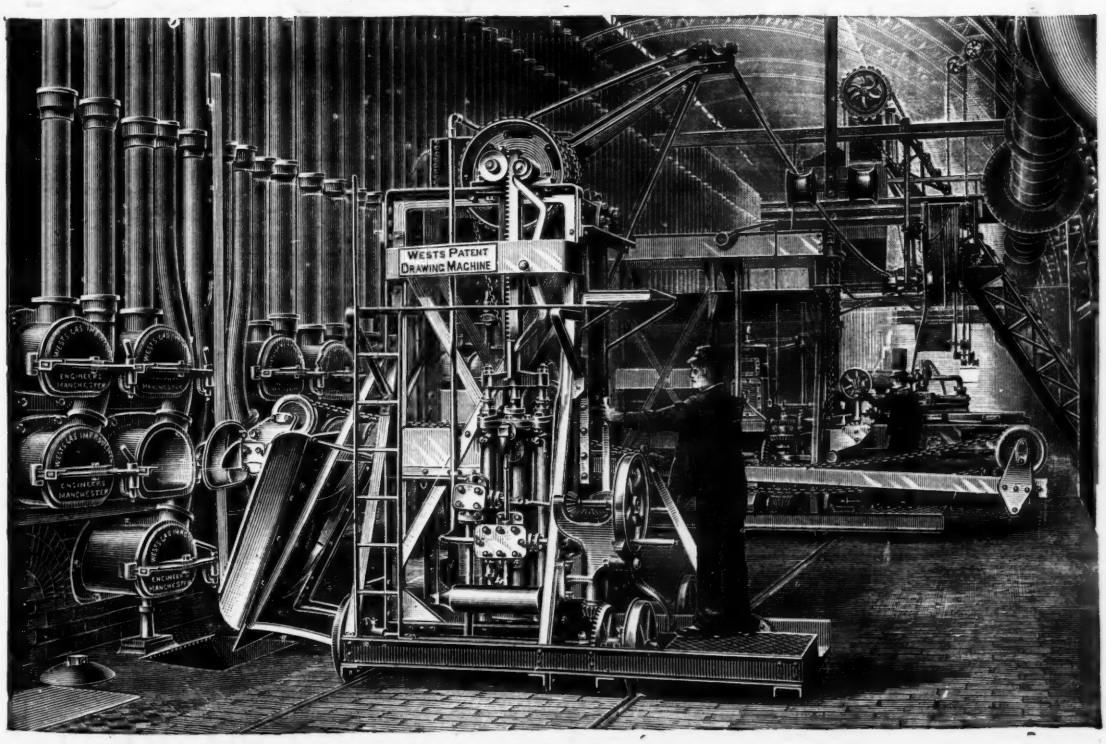

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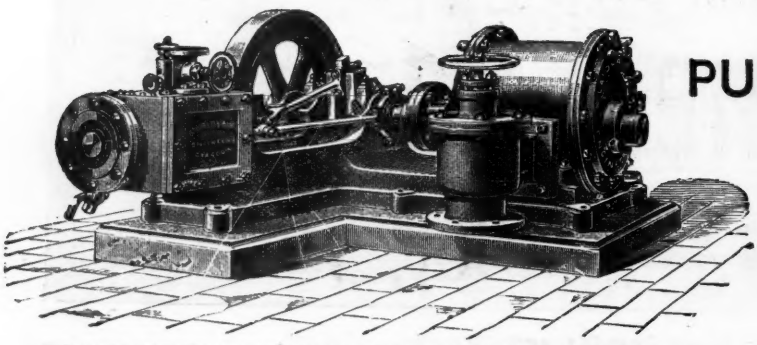

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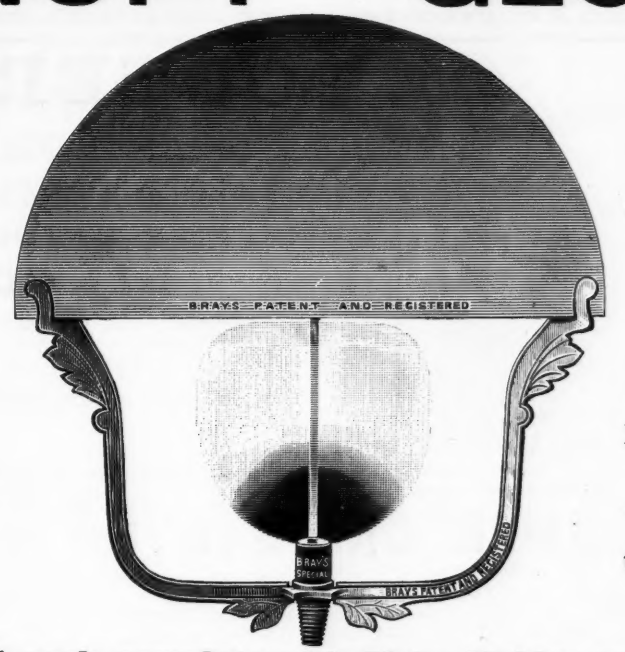

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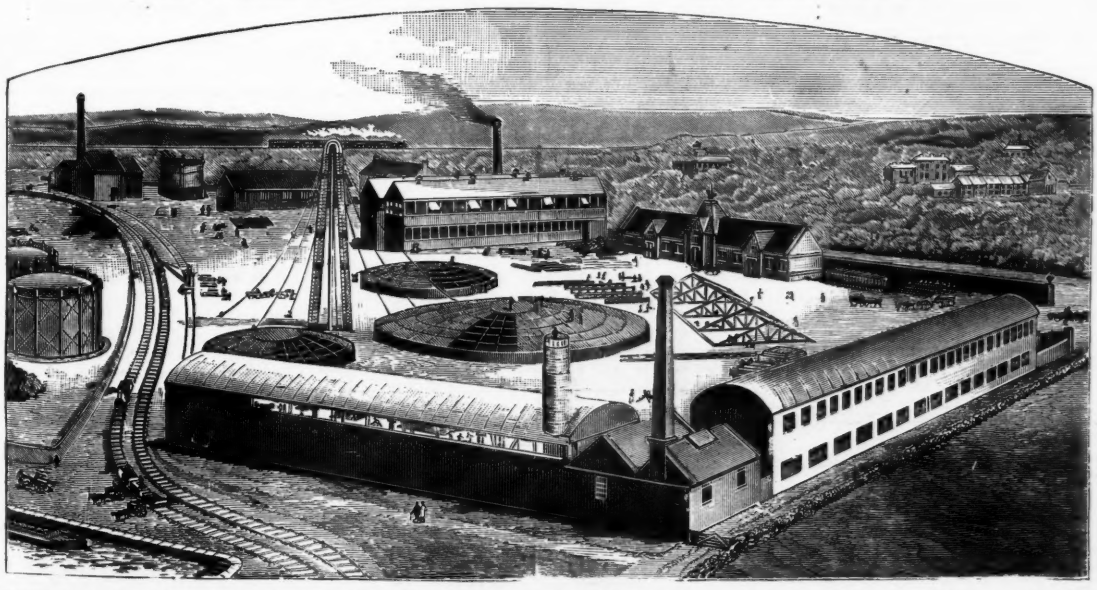

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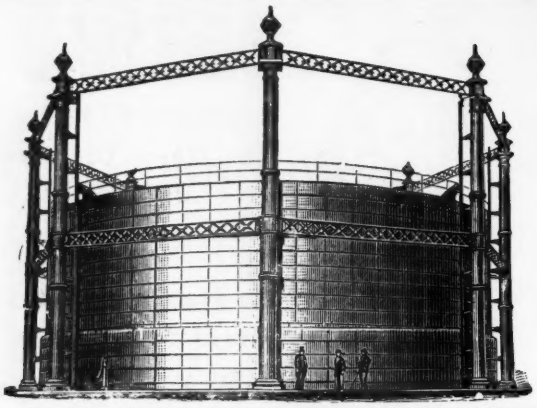

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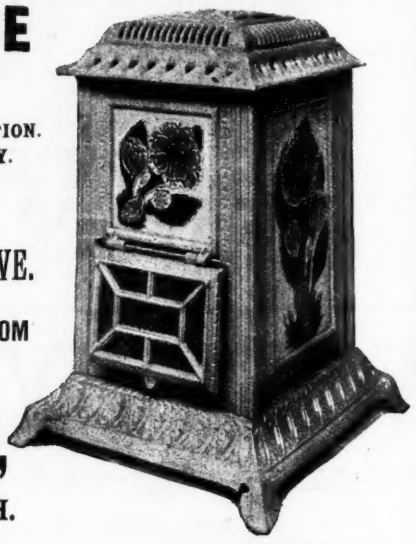

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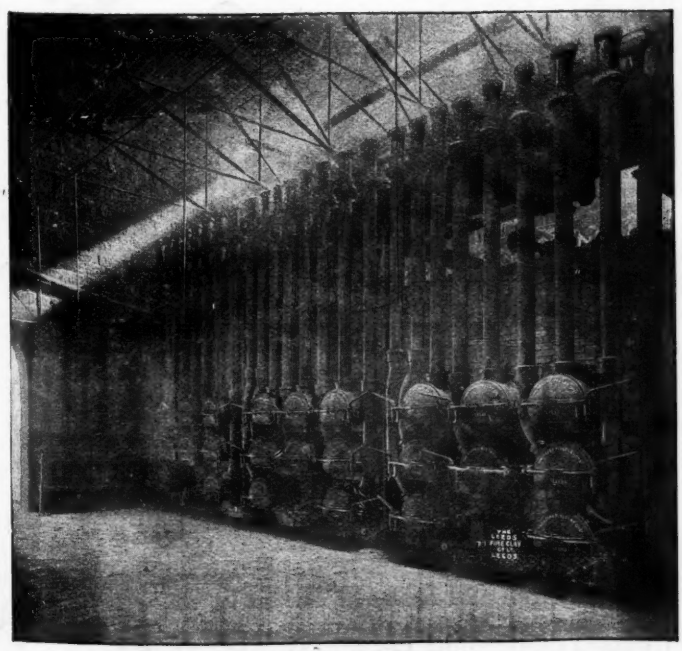

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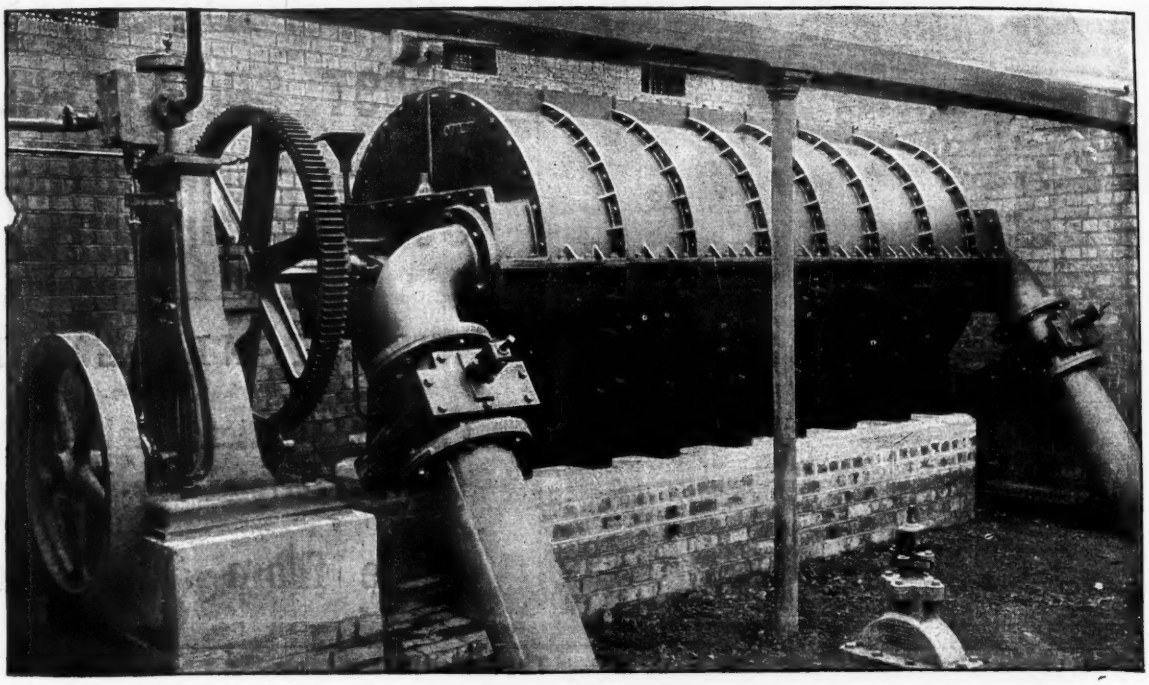

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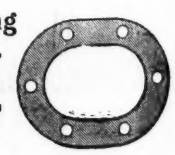

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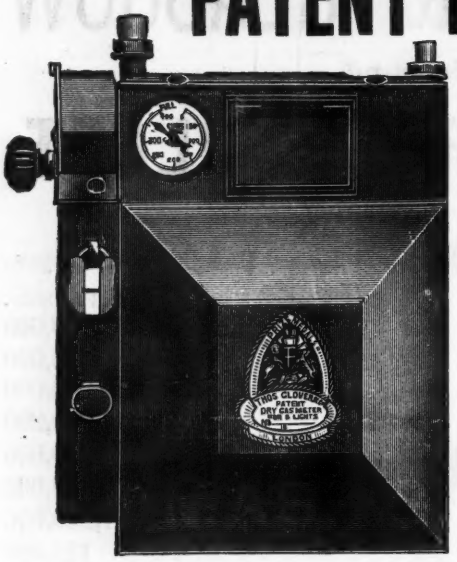

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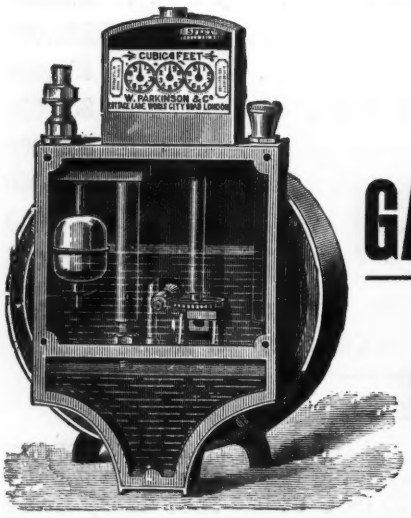

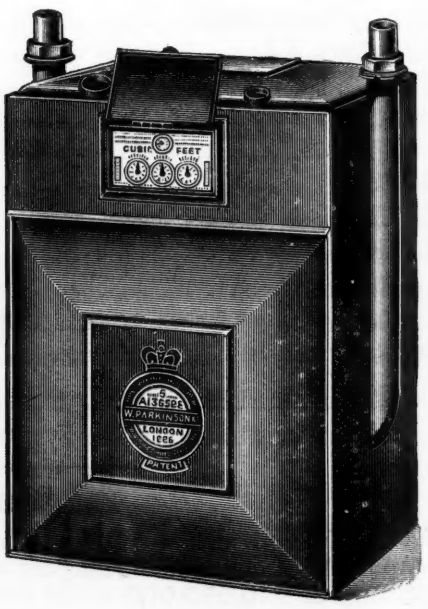

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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
The Rossendale Assessment Appeal—An Approximate Rule of Valuation . . . 1279
The Questions of Professional Etiquette and of Expert Evidence. 1279
London Municipal Reform . . . 1280
The Character of the Liverpool Gas Supply . . . 1280
Mr. Richmond's "Slot-Cooker" Articles . . . 1281
Further Correspondence on the Smoke Nuisance . . . 1281
The Workmen's Compensation Act—Quick Adjudication . . . 1281
WATER AND SANITARY AFFAIRS—
The Progress of the Metropolitan Water Inquiry . . . 1282
Lord Onslow on the London Water Question . . . 1282
The Water Bills of the London County Council . . . 1282
The Midland and South Hants Water Schemes . . . 1282
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 1283
Electric Lighting Memoranda . . . 1283
The "Robert Hunter Fund"—Fourth List of Contributions . . . 1281
The Law and Practice of Smoke Prevention . . . 1284
The Russian Mineral Oil Supply . . . 1285
NOTES:—
The Lighting of Class-Rooms . . . 1286
The Use of Water Gas in Metallurgy . . . 1286
Engineers and Architects . . . 1286
Wind Velocity and Rainfall in the Barbados Hurricane. . . . 1286
COMMUNICATED ARTICLE:—
Slot Cookers and All About Them. By E. W. T. Richmond. Concluding Article . . . 1286
TECHNICAL RECORD:—
Acetylene. Second Cantor Lecture by Professor Vivian B. Lewes, F.I.C., F.C.S. . . . 1290
American Gaslight Association . . . 1294
REGISTER OF PATENTS:—
Burners for Incandescent Gas Lighting—Wilson, J. . . . 1295
Production of Acetylene—Ravel, L. de . . . 1295
Gas Heating Apparatus—Richmond, E. W. T. . . . 1295
Regenerative Furnaces for Gas-Retorts—Helps, G. . . . 1296
Acetylene Generator—Kremer, J. . . . 1296
Increasing the Illuminating Power of Coal Gas—Wigham, J. R. . . . 1296
Inclined Retorts—Drake, J. A., and Marsland, J. S. . . . 1296
Producing Acetylene—Lake, H. H. (Grand, J.) . . . 1297
Condensing Gas-Stoves—Fletcher, T., and Neil, J. . . . 1297
Acetylene Generators—Manger, T. . . . 1298
Patent Notices . . . 1299
CORRESPONDENCE:—
The Carburation of Coal Gas. . . . 1298
Prepayment Meters . . . 1299
Corrections . . . 1299
PARLIAMENTARY INTELLIGENCE:—
Notices of Applications to the Board of Trade for Provisional Orders (Session 1899) under the Gas and Water Works Facilities Act, 1870, and the Electric Lighting Acts, 1882 and 1888 . 1299
Notices of Applications to the Local Government Board (Session 1899) for Provisional Orders under the Gas and Water Works Facilities Act, 1870, and the Public Health Act, 1875 . . . 1300
LEGAL INTELLIGENCE:—
High Court of Justice—Chancery Division—Welsbach Incandescent Gas-Light Company, Limited, *v.* The Daylight Incandescent Mantle Company, Limited . . . 1300
Preston (Adjourned) Quarter Sessions—The Assessment of the Rossendale Union Gas Company. . . . 1300
Greenwich Police Court—London County Council *v.* South Metropolitan Gas Company . . . 1303
Tampering with Water-Pipes . . . 1304
Thefts from Prepayment Meters . . . 1304
MISCELLANEOUS:—
The Gaslight and Coke Company's Stock-Conversion Scheme . 1304
Manchester Corporation Gas Undertaking . . . 1305
Birmingham Corporation Gas Supply . . . 1305
Sales of Stocks and Shares . . . 1305
Electric Lighting Notes . . . 1306
Metropolitan Water Supply Commission—Thirty-seventh and Thirty-eighth Days . . . 1307
Lord Onslow on the Metropolitan Water Question . . . 1309
Welsh Views on the London County Council's Water Scheme 1309
Arbitration under the Staines Reservoirs Act . . . 1309
The Bridlington Water-Works Purchase Award . . . 1310
Notes from Scotland . . . 1311
Current Sales of Gas Products . . . 1311
Coal Trade Reports . . . 1311
Gas and Water Companies' Stock and Share List . . . 1312
PARAGRAPHS:—
PERSONAL: Alderman Mills; Mr. F. P. Tarrat. . . . 1285
British Association of Water-Works Engineers . . . 1283
The Value of the Calorie—Professor Lewes on Acetylene—The Bacterial Treatment of Sewage . . . 1285
Private Bills in Parliament—Acetylene Gas for Railway Carriage Lighting—Large Water-Meters—Mineral Resources of the Philippines . . . 1290
Gas Workers' Pay and Holidays at Blackburn—Street Lighting by the Incandescent Gas System—Letting Gas-Stoves on Hire at Southport. . . . 1295
New Joint-Stock Companies—Tipton Gas Committee . . . 1299
Oil *v.* Gas at Aldeburgh—Gas Workers' Wages at Darlington—Brighouse Gas Supply . . . 1304
Additional Stoking Machinery for the South Metropolitan Gas Company—The Water Supply of St. Agnes. . . . 1306
Llanrwst and District Water Supply . . . 1308
Ramsgate Corporation Gas and Water Supply—Service-Pipes and Street Paving—Tar Distilleries in Holland—Electric Light in Kandy (Ceylon)—Dorchester Corporation and the Gas-Works . 1312
Sulphate of Ammonia Plant for the Ilford Gas-Works—Gas and Electricity Affairs at Leigh—Entertainment at the Midland Iron Works, Donnington—Birmingham Corporation Water Supply—Belfast Water Supply—Additional Water Supply for Lincoln . 1313
Gift of a Water Supply to a North Yorkshire Village—Gomersal Water-Works Purchase—Liskeard Water-Works Loans—Chard Water Supply—Newhaven and Seaford Water Company—Prospective Amendment of the Workmen's Compensation Act—The Maidstone Corporation and the Water-Works—The Winding-Up of the Matlock Water Company—Opposition to the Midland Water Scheme. . . . 1314
Award in the Malvern Arbitration—East London Water Supply . 1315

EDITORIAL NOTES.

The Rossendale Assessment Appeal—An Approximate Rule of Valuation.

AN important assessment appeal case has just been disposed of by the Court of Quarter Sessions sitting at Preston, as reported in another column. The appellants were the Rossendale Union Gas Company; and the Court was composed of Mr. W. H. Worsley Taylor, Q.C., Chairman, and six other Magistrates. The respondents had to support a supplemental valuation of last April amounting to £7477; this being an increase of £1118 on the previous valuation based on the Company's accounts for 1887. It was argued that the property had become more valuable in the interval—a general proposition not to be gainsaid. There was, however, the usual difference of opinion on the point of the hypothetical tenant's requirements and allowances in the circumstances. Counsel fenced a little over the customary 7½ per cent. interest on the tenant's capital, which is surely superfluous at this time of day. The respondents had taken thought, and even improved upon the appraisement appealed from. How differently the same data may be handled by opposing interests appears in the valuations made by Mr. John Cross and Mr. Thomas Newbigging. The whole proceedings are a valuable lesson in the difficult art of which these gentlemen and the other expert witnesses called are acknowledged masters. A short way of expressing the fact is to say that the net rateable value consented to in 1888 was an amount equal to one-half of the net receipts of the Company for the year; and this is approximately the same ratio of valuation now confirmed by the Court. For the Company's appeal was dismissed, with costs to follow the decision arrived at. It would never do, of course, to accept without reserve the proposition that the rateable value of every gas undertaking is just half the balance of receipts over expenditure. But this is very nearly what the valuation has come to in the Rossendale example, after much head-shaking over such considerations as the charge for meter-taps and the fixing thereof. Is a main-cock part of the service-pipe or part of the meter? Incidentally, we should say that it is certainly a movable fitting, inasmuch as when the supply is permanently cut off from a house, the service is capped. To argue otherwise, because for the sake of convenience the Company leave the main-cock when there is a reasonable prospect of the supply being renewed, is to strain a voluntary act into a law, which is absurd. It may not be strict assessment practice to bye-pass all these details, so far as the monetary aspect of them is concerned, and get at the net rateable value by the short way already indicated; but the handy rule is at least useful for gas engineers to work by in "cubing up" their undertakings.

The Questions of Professional Etiquette and of Expert Evidence.

AT the opening meeting for the season of the Surveyors' Institute, the President (Mr. Robert Vigers) delivered an Inaugural Address which contained several points of much interest for professional men in general. In the speaker's profession, as in every other, there are men "who are in "such haste to get business and extend their professional "connection, that they are not over-fastidious as to the "means they employ to achieve the end in view." This is a cry that resounds throughout the ages. The tout, the sycophant, the under-seller, the unfair rival in trade, has always existed; and it is pretty safe to say always will. "Some of these persons (such is their eagerness) openly "advertise, and tout for the business which does not come "to them as the natural reward of skill and knowledge; "while some, even less to be admired, strive in various "specious ways to discover and appropriate the connec-"tions of others." Too true; and there are those who, greatly daring, venture to question the utility of such organizations as the Surveyors' Institute and the Institution of Civil Engineers, when such notorious evils are allowed to pass unchecked by these bodies. Mr. Vigers justly observed that it is the first duty of members of an honourable profession to do everything in their power to discourage and defeat these practices. Offences of the kind, he went on to say, are generally (not always) committed by young men, who, as often as not, err through ignorance. To these the President would say that a stable business is rarely, if ever, built upon such foundations; and even in the few exceptional cases where this occurs, the result is achieved at an immense sacrifice of reputation and of

that self-respect which goes so far to brace and encourage a man in the troubles and vicissitudes of life. This is doubtless true; but all experience shows that men's interpretation of what is due to self-respect is a very shifting quantity. Many professional men, who might be suspected of honesty by those who have had no dealings with them, will do things "in the way of business" that would make a costermonger blush. These men are really no better than blackmailers; but they carry on their depredations shamelessly, knowing that it will be worth nobody's while to expose them, and burying their conscience in their bank balance. On the other hand, there is much excuse for the young expert, who sees the valuable appointments in his profession monopolized by men who are mere figureheads. How is he to break down the wall of privilege that appears to surround certain ponderous practitioners, who seem to be "in everything," while he cannot get an opening for showing how much more he knows about it?

Mr. Vigers went on to speak about the divergencies of expert evidence, particularly with regard to valuations, which are often made the butt of "foolish and unjust" jesters. His observations upon this subject were instinct with dignity. "He was free to admit that there was an "occasional extravagance of the kind in one direction or "another"—ahem! He hastened to point out that, as a matter of fact, it frequently happens that the difference between extreme valuations on the same side are just as great as between extreme valuations on the two sides. Does this mean that the whole business of valuation is guess-work? By no means. It is largely influenced by the "personal equation"—that is all. Besides, the art of valuation is not an exact science, and will never be made so. It rests not only on fact, but also on opinion, "and, "what was more, on opinion founded to a large extent "upon varying personal experience and an estimate of "probabilities and contingencies, which might or might "not arise, but which, if they did arise, largely influenced "the result." This is what makes a valuation so charmingly uncertain. Mr. Vigers very reasonably objected to the putting of expert witnesses on oath. He would much rather see the expert put up as a technical advocate for his own side, to stand his ground as well as he could against the attack of the other party. Nobody expects Counsel to speak "the truth, the whole truth, and "nothing but the truth." Why should the disinterested expert be laid under any other obligation beyond that of expressing his honest opinion, for what it may be worth? How can any man swear that his own opinion of any matter of dispute is absolutely true? There is much to be said for Mr. Vigers's way of regarding expert evidence as being of necessity largely speculative, and consequently not fairly coming within the scope of the oath that may be rightly taken by a witness of fact.

London Municipal Reform.

It is a very great pity that Party politics so hopelessly divide the worthy gentlemen who, by their interest in, and devotion to, the arduous cause of London self-government, shame the heedless bulk of the Metropolitan population, who care for none of these things. The result of this division is that outside the London County Council the opposing Parties of this body still find themselves banded into conflicting voluntary organizations, committed to absolutely contrary ways of dealing with the problems of Metropolitan administration. One Party—so-called Progressives—appear to aim at getting all executive power in everything into the hands of the London County Council. The other Party—called "Moderates"—have "posted "themselves," as the French say, on the side of further devolution of powers to the more decentralized local governing bodies which actually do in London the work of municipal authorities. The voluntary organization identified with the Moderate Party in Metropolitan politics is the London Municipal Society, which held its fifth annual meeting last week, under the presidency of Lord Farquhar. We have nothing to do here with the Party politics of the members of this or any other association; but with the prospects of Municipalism in London we certainly are very much concerned. It cannot be truly said that the present order of Metropolitan government is satisfactory. The attitude of the chief administrative body—the London County Council—towards the great private Corporations which have hitherto supplied the Metropolis with the most important and necessary public services, is not such as to encourage these interests to wish for a large extension of the powers of the Council. On the other hand, the local government authorities among whom the Metropolitan area is subdivided are not in general equal in dignity, repute, and efficiency to the enormous responsibilities of their position. It is impossible, as it would be ungrateful to the worthy men who do the work, to deny that, on the whole, London is the best-governed city of anything like its own class in the world. We English are prone to abuse our own Government; and we are always complaining of the shortcomings of our town administrations—especially the Metropolitan. But still we know all the time that, for honest and fair government, healthiness, good services of all kinds, cheapness and convenience for living and working, there is no capital city like London.

But, of course, we should not be Englishmen if we were satisfied to leave well alone. It is therefore understood that something must be done to improve the government of London. To the question of how this is to be done, there are conflicting replies. So far as can be gathered from published utterances, the Progressive remedy for all complaints is stereotyped in the formula, "Leave everything "to the London County Council!" This short and easy way, however, fails to commend itself to the general public. With all its good intentions, the County Council has unhappily received a bias in a particular direction which often causes grief to its own well-wishers. It cannot be trusted to do the sensible, straight, and prudent thing where so-called "popular" interests, even though patently factitious, are in question. It will bow to the clamour of costermongers with votes, when it will try to ride rough-shod over a Water Company with only law and justice on their side. And so long as the London County Council continues to lie under this suspicion, so long will there be extant a strong reluctance to entrust it with greater powers. Besides, there are limits to the capacity and time even of a Progressive London County Councillor; and, not to labour the point, it is felt that, as the good work done by municipal bodies in England is a natural product of the local patriotism and local interest of their members, so, if London is to exhibit the same spectacle of sound, adequate municipal work, the same conditions must be applied. The local administrations should be in the hands, not of clever "carpet-baggers" from the Temple and Fleet Street, nor wholly in those of enterprising local builders, auctioneers, and small shopkeepers, but be manned by a truly representative selection of all worthy orders in the community.

It is reported to be the intention of the Government to introduce in the ensuing session of Parliament a measure for elevating the District Local Authorities of the Metropolis to the rank of Municipalities, with Mayors and Corporations to take the place of the existing Vestries. It will be objected by the Progressives that this is the wrong way to attack the difficulty of dignifying Metropolitan politics; but the point is debateable. Whatever is done in the matter, it will be impossible to give to London a homogeneous municipal government like that, say, of Glasgow. The water supply, the gas, the electric lighting—all these, and many more public services, will remain outside the scope of the London Municipalities. But these bodies will have much to do, all the same; and there will be work upon them for the best intellects and highest characters to be found among the resident inhabitants of the neighbourhoods involved in this important scheme of reform.

The Character of the Liverpool Gas Supply.

When the cobbler sticks to his last, he is a shining light in a world full of people overmuch given to meddling with things which they do not understand; but when the worthy tradesman undertakes to settle the affairs of the universe from his own stool, he, too, becomes a futility. Mr. Oliver J. Lodge, whose work in various departments of physical science has made his name known far and wide, would be one of the last men to talk at large and in vague language about the points of one of his own specialities as inquirer or teacher. Yet writing as a Liverpool householder, "with "an amateur's knowledge of chemistry," Mr. Lodge informs the readers of a Liverpool newspaper that the city is being supplied with "adulterated coal gas." He then proceeds to traduce the character of the "stuff from Garston," without, however, offering anything besides his own opinion to prove that the commodity is deserving of condemnation

He admits that the Liverpool gas supply "is carburetted "so as to be reasonably luminous;" but he declares that "it gives a poor light unless burners specially adapted to "it are employed. It clogs ordinary burners; it is not so "good as natural coal gas for gas-fires; and whenever "it escapes unburnt it is poisonous." Mr. Lodge must perceive that no question of chemistry is raised by this indictment. With the exception of the last point, which must be dealt with separately, all these allegations are matters susceptible of experimental physical demonstration. What special burners are now required to consume Liverpool gas? Where are the ordinary burners clogged by this gas? How and where has it failed the users of gas-fires? Mr. Lodge may take our assurance that these are questions which gas engineers would like to have resolved for their guidance. In default of evidence, such complaints amount to no more than the familiar grumble that "the gas is bad," which nobody takes into serious consideration. With regard to the "poisonous" quality of the unburnt gas, this is a consideration that has no natural connection with the behaviour of the same gas when burnt. No intelligent person needs to be told than carbonic oxide gas is a good deal worse to breathe that "bad air;" but do Liverpool people habitually use their gas supply for this purpose? The Liverpool Gas Company have what they regard as good and sufficient reasons for fulfilling their statutory obligations in the manner actually adopted. If they were an electric lighting company, they would probably exercise their own discretion, in a similar spirit, as to the voltage of the current sent into their distributing mains. Would Mr. Lodge argue that a supply company should have no discretion of the kind? The concern of the public with the contents of the Gas Company's pipes is of the same character as their interest in the condition of an electric conductor—at least, it is so for the purpose of the present argument.

Mr. Richmond's "Slot-Cooker" Articles.

We complete to-day the series of articles on "Slot Cookers "and All About Them," which Mr. E. W. T. Richmond has during the past few weeks contributed to our columns; and we think those who have perused them will acknowledge that they have furnished matter of very considerable interest. When, four years ago, Mr. Nasmith told us that the coin-in-the-slot system was the invention of Hero of Alexandria, the question put by the Preacher of old: "Is "there anything whereof it may be said, See, this is new?" came at once into one's mind. And we now learn with respect to this so-called modern production, that "it hath "been already of old time." Mr. Richmond has shown us that an arrangement of the kind was in use in the Eastern temples many years (even centuries) before Hero. But he has also shown—and this is of much more importance to our readers—how wonderfully the automatic system of supply has extended the use of gas. We have seen how, by its aid, the cleanliest of all fuels has found wider application in the houses of the lower middle classes, and made its way into the humbler dwellings of the artisan and the toiler—lightening the labour of the housewife, and adding to the comfort of those under her care. Whoever may be called upon to write the history of the gas industry during the eventful century now fast drawing to its close, will be an unfaithful historian if the important development which has been here dealt with does not receive full justice; and we venture to think that when he reaches this stage of his work he will find much useful material ready to his hand in the articles now concluded.

Further Correspondence on the Smoke Nuisance.

Last week's contributions to "The Times" correspondence on the smoke nuisance do not advance the solution of the practical problem. Mr. R. Reynolds writes from Leeds to give the results of ten years' sunshine observations carried on in the city and one of its suburbs under the auspices of the Leeds Philosophical and Literary Society. Since 1887, the Society has kept a photographic record of the daily amount of sunshine at three stations. From this it appears that the recorded sunshine in Central Leeds averaged over the period named 26·7 per cent. less than the amount registered at Adel, some four miles away, and 330 feet higher. On Sundays, the relative deficiency was only 16·8 per cent.—"Here is a new reason for naming the "first day of the week Sunday!" The question of what to do with domestic smoke naturally arises out of these statistics. What have the Leeds Corporation Gas Department been doing to help in keeping down the smokiness of their city atmosphere? Another correspondent of "The Times" flatly says that there will be no hope for any town outside the adoption of anthracite fuel for domestic heating purposes. He is a coalowner, and ships "hundreds "of thousands of tons yearly to foreign countries; the "anthracite, prepared for domestic use, being bought "chiefly for large Continental cities, notably Paris and "Berlin." Good business! Doubtless the writer is correct in stating that smoke prevention is a question of the use of smokeless fuel; but how is this to be brought about, save by the slow, patient application of gas to the purpose? One has heard all about anthracite before; but, for very obvious reasons, it has never been taken to kindly by the householders of any part of the country out South Wales.

The Workmen's Compensation Act—Quick Adjudication.

Those all-important "prepositions" of the Workmen's Compensation Act are certain to give a good deal of trouble yet, before all their possible bearings are legally defined. The Appeal Court has had to deal with the instructive case in which a builder's carman suffered from an accident that happened in the street outside his employers' premises. We last mentioned this case in the "Journal" for the 8th ult., and already we have to record the astounding fact that the matter has gone to the Appeal Court, been decided, and everything settled in less than a month! Why, the professional jokers will have to leave off poking their fun at the law's delays, if this pace is kept up. Already it appears that ordinary litigants are beginning to complain of their business being pushed aside for these new appeal cases under the Workmen's Compensation Act; but it is more to the point to cite this procedure as a shining example of what that "Old Father Antic, the Law," can do if he likes. The whole drift of the Workmen's Compensation Act was meant to disestablish the lawyers from their usurped right of delaying and complicating all litigation for the sake of piling up costs. Of course, the respectable family or commercial practitioner would swear that such a thing was never done in his office; but everybody who has ever had the ill-fortune "to sue or be sued" knows how it is. The Workmen's Compensation Act, with its attendant rules, has changed all this. If the parties can agree at first hand, well and good. If not, the County Court will "see fair" in the shortest possible time. Is anybody still dissatisfied? The Appeal Court is "over "the way," so to speak; and Mr. Justice A. L. Smith will define the law "while you wait." In the case in point, the only question was as to the meaning of the word "about," in connection with a factory. A cart standing in the street outside the gate is clearly neither on nor in the factory, but is "about" it. How far the term might be held to extend—what is its range, that is to say—was not the question. It is not the way of English law to lay down general definitions. Sufficient for the tribunal are the facts of the case. As we have already remarked, factory owners may as well reconcile themselves to the conclusion that these statutory prepositions go a very long way.

THE "ROBERT HUNTER FUND."

Fourth List of Contributions.

We acknowledge below the contributions to hand for this fund up to yesterday; making a total of £235 17s.

Amount already acknowledged	£190 3 0
A Friend, per H. V.	1 1 0
Batt, Mr. William, Eccles	1 1 0
Colson, Mr. Alfred, Leicester	2 2 0
Dougall, Mr. Andrew, Tunbridge Wells	2 2 0
Green, Mr. Benjamin, Mitcham	1 1 0
Harman, Mr. Edward A., Huddersfield	1 1 0
Hepworth, Mr. Joseph, Edinburgh	2 2 0
King, Mr. William, Liverpool	1 1 0
Llewellyn Jones and T. B. Younger, Messrs.	1 1 0
"Mack"	2 2 0
Mackay, Mr. Alex., Edinburgh	10 10 0
M'Gilchrist, Mr. James, Dumbarton	1 1 0
North, Mr. Fred J., Stourbridge	1 1 0
Pye, Mr. James, Chester	2 2 0
Scott, Mr. J. W., Newton Heath, Manchester	1 1 0
Smith, Mr. B. W., Smethwick	1 1 0
S. R.	1 1 0
Valon, Mr. W. A., Ramsgate	3 3 0
X.Y.Z.	10 0 0
	£235 17 0

WATER AND SANITARY AFFAIRS.

Viscount Llandaff last week expressed his surprise at hearing from Mr. Reginald Middleton, when the latter was giving evidence before the Royal Commission, that the proposed supply of Welsh water would require to be filtered. He thought it was to be "pure nectar;" and he was asking whether it would not be cheaper to get pure and good water from Wales by gravitation than to take flood water from the Thames that would have to be pumped and filtered. That Welsh water required filtration was a fact previously unknown to the Chairman of the Commission. But if the Parliamentary Notice for the County Council Bill on the subject is put in as evidence, it will be seen that the projected works include filter-beds near Edgware and Hendon, in the county of Middlesex. The vision of "pure nectar" thus vanishes. In respect to the quantity of water available from present sources of supply, Mr. Middleton went far beyond the calculation of Lord Balfour's Commission. The report of 1893 reckoned on a daily supply of 300 million gallons from the Thames, 52½ millions from the Lea, 40 millions from wells and springs in the chalk of the Lea Valley, and 27½ millions from wells in the chalk area in the district of the Kent Company; making a total of 420 million gallons per day. Mr. Middleton raises the Thames supply to 400 million gallons per day, and brings in a supply of 123 million gallons from "other wells in Kent," besides 2 million gallons from the Southwark and Vauxhall well. Adopting the same figures as the Balfour Commission in respect to the Lea, the wells in the Lea Valley, and wells in the Kent Company's district, he gets a total of 645 million gallons per day in place of the 420 million gallons in Lord Balfour's report. But the calculation does not end at this point, for Mr. Middleton reckons on a further supply of 190 million gallons from wells sunk in the chalk. This last item may be supposed to have reference to the opinion expressed by the Balfour Commission that a large supply of water might be obtained from the chalk area east of the Kent Company's district, in the basin of the Medway, and in the district farther east. Thus Mr. Middleton obtains his total of 835 million gallons per day, or within a trifle of twice the quantity reckoned upon in the former inquiry. In this way a population exceeding 20 millions would be provided for, in place of the 12 millions mentioned in the Balfour report. As the latter number was supposed to represent the utmost population of Greater London in the year 1931, the larger number of 20 millions will, of course, carry the period on to a yet remoter date. Mr. Middleton might very well say that there was enough water in the Thames watershed to supply 18 millions of people. If no margin is allowed, the total quantity of 835 million gallons per day, at 35 gallons per head, is equal to a population of more than 23 millions. In respect to cost, Mr. Middleton expressed his belief that the Welsh scheme would result in a deficit up as far as the year 1948. He estimated that by the time the Welsh supply equalled 215 million gallons per day, it would cost fully £33,000,000. For 123½ million gallons per day it would cost about £21,000,000; while the Thames storage reservoirs would furnish the same at a cost of little more than £6,600,000, including £1,155,000 for additional mains. No doubt Mr. Middleton's figures will be fiercely attacked; but there is every reason to believe that he knows what he is talking about.

Further light is thrown upon this subject by Lord Onslow's address to the members of the Junior Constitutional Club last Thursday night. His Lordship grieved very much to find many of his friends on the County Council sharing in a panic owing to the state of affairs in East London, and consenting to the introduction of the Purchase Bill with its unjust arbitration clause. But he believed Parliament would insist upon waiting for the report of the Royal Commission before giving its vote on the second reading. As for the settlement of the water question, he avowed his conviction that it could only be disposed of by the acquisition, by some public authority, of the undertakings of the Water Companies. Then followed the question as to the cost; and on this point Lord Onslow presented some formidable figures. He quoted various estimates, and finally took a medium price —that of £35,000,000—though he remarked that the Stock Exchange value was about £39,000,000. But, at the medium rate, the annual charge, after duly providing for a sinking fund, would be £1,167,000. The present income of the Water Companies he took at £990,000. We may observe that this is under the mark. But here there at once appeared to be a heavy drawback, supposing Lord Onslow to be correct in saying that it would be obligatory on any public authority to bring down the charge for the supply to the level of the lowest rate which was now paid. On the top of all this there would come an expenditure of £16,500,000 in order to bring a supply from Wales. In this particular Lord Onslow might very properly raise his estimate, if we are to judge by the standards of Manchester, Liverpool, and Birmingham. But taking even this insufficient amount, the total annual charge becomes £1,717,000; leaving London to bear a loss of £727,000 per annum—equal to a rate of nearly 5d. in the pound. Considering what will be sacrificed by bringing down the charge to the consumer to the lowest level, it will be seen that the burden on the general rate will be more likely to exceed 5d. in the pound than to fall below it. As for the authority that should possess the supply, Lord Onslow did not consider it wise to entrust the administration of one of the first necessaries of life "to a body which was swayed entirely by political "considerations." One awkward question remains. Supposing a Trust to be created, are we sure that it would be any better than the County Council? Does the London ratepayer think it worth while to pay an extra 5d. in the pound in order to oust the Water Companies and make a doubtful experiment?

Last week we gave a list of the Water Bills to be promoted in Parliament in the coming session. Among them were five from the London County Council; the Welsh project being split into two Bills—one for the construction of reservoirs in Wales, and the other for an aqueduct to London with the necessary terminal works. A third Bill provides for the purchase of the London Water Companies; and a fourth for the raising of the money required to carry out the different proposals. The fifth Bill is, strictly speaking, only indirectly connected with the water question; being a General Powers Bill relating to a variety of subjects, but including clauses affecting the Lea Conservancy and the New River and East London Water Companies. Concerning the Welsh project, it appears that the Parliamentary Committee of the Council are behind time with the plans and books of reference required in connection with the Aqueducts Bill, and will have to apply for a suspension of the Standing Orders. The application is to be made in due course; and the belated work is being proceeded with as rapidly as possible. The two Bills to be brought forward by the East London Company, as well as that by the West Middlesex Company, and the intercommunication Bill of the eight Companies, provide for carrying on the present water supply in an efficient manner. We may here allude to the fact that yesterday the constant supply was resumed in a great part of the East London district, and will shortly cover the whole area.

With respect to the Bills of which notice has been given relative to the Provincial Water Supply, it will be observed that the River Derwent and its tributaries are rendered somewhat conspicuous. The Corporation of Leicester have an extensive scheme for the construction of storage reservoirs and other works; and seek authority to appropriate the waters of the Rivers Derwent and Ashop, and all their tributary streams above a certain point. The creation of a Joint Board is intended, composed of the Corporations of Leicester and Derby. The Corporation of Derby, on their part, give notice of a Bill enabling them to carry out a scheme of water supply from the Derwent, in conjunction with other Corporations, as well as with County Councils and Local Authorities or bodies. The Derbyshire County Council are prominent in the Bill. But Sheffield comes into the field with a Bill of its own, proposing to take water from the Derwent and Ashop Rivers, and threatens opposition to the Leicester and Derby Bills. A Joint Committee is to be formed, to consist of members of the Rotherham and Doncaster Corporations; but the water-works are to constitute part of the undertaking of the Sheffield Corporation. In reference to a very different watershed, we find the Bill of the South Hants Water Company proposing to extend the limits of supply, so as to include a goodly number of places in the county of Southampton. But the Bill is specially remarkable as resembling that of the East London Company, by seeking to make it compulsory on owners of property to provide

cisterns—the Company prescribing the size, and making regulations respecting these appliances. Many of the Water Bills are locally important, though not presenting an aspect of magnitude. But, taken in the aggregate, the water supply of the country is undergoing, from year to year, an extraordinary development.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1312.)

BUSINESS on the Stock Exchange last week was certainly more active on the whole, though the animation was not strong enough to last right through to the close. The tendency at first was quite favourable; and things were going along quite nicely, when a smart demand for gold in mid-week administered a sharp check, and showed how sensitive the market is. But the recovery came as quickly as the fall, when it was seen there was no ground for apprehension; and the week finished off very quiet and rather apathetic. In the result, prices are not uniformly higher; but the advances largely predominate over the retrogressions. The settlement was light; and it went through with complete ease. In the Money Market, outside the gold incident already mentioned, temporary accommodation was abundantly met; and the demands for settlement purposes made no impression on the plethora. Business in the Gas Market was more animated than it has been for many a week, thanks to the remarkable liveliness of Gaslight "A," over which there was a little struggle in view of the sale of stock at the Mart which is taking place to-day. The opposition prevailed at the opening; and a special parcel was done as low as 282. Then the supporters came in; and on Tuesday 286 was marked. On Wednesday and Thursday, there was animated dealing. But the stock held on tight; and after a little quieter business on Friday and Saturday, it marked 287½—the best price of the week—at the close. The secured issues meanwhile were not idle; but they did not change price. South Metropolitan was moderately dealt in; the price showing no disposition to rise. Nothing was marked in Commercials; business being all in the new allotments. Quotations are now "*ex* new;" but they have not been put down the full value, which is about 8½ per cent. Nothing special was done in the Suburban and Provincial; and the only change is that Newcastle is quoted closer. Business in the Continental Companies was only moderate. The tendency generally was steady; and Imperial just at the close scored a point in advance. Among the rest, Hongkong and San Paulo had a rise; and Oriental and Chicago gained on "*ex* div." variation. Water was rather quiet, and mostly unchanged; but Southwark, after much shifting about of the quotation, closed at a fair advance.

The daily operations were: Gas stocks were quiet on Monday; and quotations did not move. Tuesday's business also was decidedly limited. But Gaslight "A" advanced 1; and Hongkong, ½. In Water, Southwark ordinary rose 2. On Wednesday, dealings in Gaslight "A" were in full swing, hardly anything else being noticed. Quotations did not vary. Southwark Water rose 1 more. On Thursday, the great activity in Gaslight "A" continued; and South Metropolitan was rather busy too. Again quotations closed unchanged. In Water, Southwark "D" rose 2. On Friday, there was a great lull in Gas stocks. Saturday was fairly quiet also; but there were more changes. Imperial improved 1; and San Paulo, ½.

ELECTRIC LIGHTING MEMORANDA.

An Electrical Supplement of the "Engineer"—Systems of Electricity Supply—The Vindication of Deptford—A Case of Traction.

THE fact of the "Engineer" having come out with an electrical engineering supplement to its issue for the 25th ult., is worth noticing as a sign of the times. It is not a very wonderful contribution to the technical literature of the subject, this supplement; a good deal of the matter looking as if it really originated in the advertisement rather than in the editorial department. But perhaps it is none the worse for this. Mr. W. H. Preece contributes an article on "Etheric Telegraphy," which describes what has been done in this interesting field. The writer concludes that etheric telegraphy is practical, but thinks its applications will be limited, "except if it be made practical between ship and ship and between ship and shore." Another article discusses the subject of "Transformers in Practice," and lays down the principle that low-tension continuous current distribution has had its best day, and declares that this system is "being relegated to the uses for which it is best adapted." We should have thought this a sign of progress rather than of decadence. Surely, to ascertain what anything is good for, and thereafter to keep it to that purpose, is good work in the world? This writer kindly concedes that small towns, in which the radius of supply is severely limited, and a central position for a generating station can be obtained, will continue to favour the low-pressure system; and the ease of its application will still render it the more economical and simple plan for use in isolated lighting plants. "Its advantages also cover the efficient charging of secondary batteries or accumulators; and it gives a more satisfactory account of itself in the running of motors, and in the efficiency of the light supplied from its arc lamps." Well, well! So long as all this can be said to the credit of the low-pressure continuous current system, it seems rather inconsequential to describe it as having seen its best day. Rather, one would think, its many advantages place the *onus* of proving their case upon those who would supplant it by another system.

The question of systems has always been a reason for the withholding of confidence in the recommendations in this regard of all but the very highest authorities in electrical science. We are not going to "name names," for obvious considerations; but the country is full of examples to show that where the smaller fry of experts have been allowed their own way, the selection of the system of supply has been determined by individual preference rather than on merits. If it happened to be an alternating current man who had the ear of the local people, then the locality was provided with a high-pressure alternating current system, notwithstanding the fact that the whole thing might be covered by a table-cloth. It must be admitted, of course, that the high-pressure alternating current has its peculiar advantages, which should be recognized and utilized when considerations of expediency dictate this course. It is unfortunate, all the same, that the known drawbacks of the system should have been imposed upon so many districts unnecessarily, while at the same time its chief recommendation—the possibility of removing the source of energy to a distance from the centre of consumption—has not been realized. In this way, the system has gained a questionable repute, which would have been avoided if the public had always been kept aware of the real and sufficient reasons for the selection of the high-pressure alternating current for particular localities.

So far as the case of London is concerned, the vindication of the high-pressure alternating current principle of electrical distribution is capable of being summed up in the one word—"Deptford." It is abundantly evident that the advantages, such as they are, of the low-pressure continuous supply, are heavily discounted by the necessity of having the generating station close at hand. We have the satisfaction of reflecting that, through all the time of trouble that too quickly overtook the inauguration of Mr. Ferranti's great conception at Deptford, we have in this column consistently upheld Mr. Ferranti's cause. He was a little in advance of his time, perhaps; but not much. A whole chapter of sad accidents came upon the unhappy London Electric Supply Corporation, and diverted business from them to their rivals. The latter were "on the spot." The generating station was "just round the corner," or "over the way;" and users of electric light did not care to depend upon a service which came from afar, and was liable to fail with startling pyrotechnic effects. But now the whirligig of Time is bringing about his revenges. All the London Electricity Supply Companies are either moving, or reluctantly coming to see the expediency of going, out of town; and Deptford will soon be no exception to the rule of locality. Of course, who says alternating high-pressure current must also say transformers; and the "Engineer" supplement is very informing on this matter.

It is quite possible that electricians may endeavour to make capital out of the recent history of the Ipswich Tramways Company. Certainly, as the story has recently been told by the Chairman of the Company, the British Gas Traction Company are made to lie under an imputation of unbusinesslike conduct. It appears that the Ipswich Tramways Company have one of those unfortunate undertakings that do not earn a dividend, and have no prospects of doing so. The capital expenditure on the tramway amounts to about £32,000; and the receipts run to about £3000 a year. The net profit for last year was £281. In the circumstances, the Directors are naturally not averse to contemplating the sale of the property; and a year ago it is alleged that the Gas Traction Company were not unwilling to buy. The price was agreed upon, the consent of the Board of Trade obtained, the agreement was prepared—and then the Gas Traction Company went no further with the business, for some unknown reason. The Tramway Company's Chairman was pushing the sale; but the other party were not equally eager. So he turned from gas traction in disgust, and fell into the arms of an electric traction syndicate who are reported to be willing to pay £20,000 for the property, if the Corporation will consent to let them come in. The Chairman admitted, on being pressed, that electric traction meant the trolley-wire system. He did not say, however, that it would also entail the relaying of the metals over the whole system. If the cost of doing all this new line work, and providing the generating station and electric car equipments, is added to the £20,000, it does not appear that the electric traction syndicate will have very much of a bargain at Ipswich. That, of course, is their affair. We can only hope that the British Gas Traction Company are concentrating their energies upon making a better proof of their cause than could be secured at Ipswich.

British Association of Water-Works Engineers.—At the general meeting of this Association to be held next Saturday, a paper will be read by Mr. H. Bertram Nichols on "Water Supply from the Lower Greensand, and Constructional Works connected therewith, at Leighton Buzzard."

THE LAW AND PRACTICE OF SMOKE PREVENTION.

A PECULIAR aspect of English life is exhibited by the recent outburst of Sir W. B. Richmond against the smoke nuisance, as experienced by himself at Hammersmith. That traditional critic of our national ways and institutions, "the intelligent foreigner," hailing, it might be presumed, from one of the highly-governed countries of Europe, would experience a considerable amount of difficulty in understanding this business. There is the smoke, and there also is the law for preventing it. Yet the people of London go on enduring the one and ignoring the other, until somebody stirs the newspapers up; and then somebody else proceeds to explain matters, and perhaps to do something. The motive power in this instance is the mysterious force called public opinion, the existence of which appears to be peculiar to these Islands. At any rate, no Frenchmen or German ever writes to his newspaper to obtain the removal of a public nuisance—to say nothing of getting a law put into operation. That is entirely an affair of the Government, or of the Police. The foreigner at home gets along without that common action through the "Correspondence" columns of the newspapers, or by public meeting, which is part of the public life of England. With us, it is only for some prominent man to strike the match, and the flames of public controversy burst forth. Our own columns contain many remarks showing how the strike of Welsh coal miners in the spring of the year, by stopping the customary supply of smokeless steam coal to the Metropolis, was bringing the smoke plague down upon London even as it weighs upon Manchester. Time and again we have recorded and commented upon Police Court proceedings initiated by Metropolitan Local Authorities against offenders—chiefly electric lighting stations—under the Smoke Prevention Acts. The electrical journals, for their part, have devoted columns to the discussion of the decisions of the Magistrates in these cases. Yet, to judge from the correspondence in "The Times" and the articles in other newspapers that followed the publication of Sir W. B. Richmond's letter, the great body of the London population did not know that anybody else had done, or was doing, anything in this matter of smoke prevention!

It is not to be wondered at that the Metropolitan Vestries, and the London County Council—and also, for that matter, the London factory owners, and the Gas Companies—should experience a slight feeling of impatience with this one-eyed public opinion, which only sees what some self-appointed showman points out to it. The Gas Companies have been quietly effecting a revolution in the domestic warming and cooking habits of the town populations of England—London included; and hardly anybody notices what is going on, until some sharp reporter on the look out for attractive "copy," artfully writes up a case where a chimney-sweep accuses the penny-in-the-slot gas-meter of depriving him of his means of earning a livelihood. Factory owners, in many instances, do their best to avoid giving offence by their chimneys; only to be abused by every "smoke abatement" amateur who knows nothing whatever about the subject of his enthusiasms. The public complain, when their attention is drawn to it, of the remissness of the Vestries as regards the enforcement of the law; but nobody helps consciously in bringing about the desired object of a smokeless sky.

Sir W. B. Richmond does well to stir up his Vestry to a sense of their duty; but, like all the other would-be curers of the smoke nuisance, his zeal outruns his knowledge. In the course of an "interview" reported in the "Daily News," he was asked whether it is really possible for "a chimney to consume its own smoke;" and his answer was—"Most decidedly, and at a profit, after the initial expense. There are no end of appliances for doing so." This is the old delusion that vitiated the programme of the Smoke Abatement Society of twenty years ago. Then the exciter of public opinion was the late Dr. Carpenter, of Croydon; and his following was composed of a handful of sanitary science people, together with a few "fashionables" in search of a hobby. Now it is the artists' turn. But both start from the same erroneous supposition. The object of the agitation is admirable; but there is no short way to it through the manufacturers' pockets. This truth should be realized. For most of the transit and industrial work of such a town as London, situated as it is with relation to the coal-fields, smokeless coal, or gas coke, will answer the steam raising purpose as well as any other description of fuel. Indeed, in all cases of a single boiler, or a pair, there is no reason why the owner should not be compelled, if necessary, by persevering prosecution, to burn smokeless fuel. It may cost a trifle more than a smoky coal; but he should not be allowed to poison the atmosphere for acres round, in order to save a few shillings a week.

It is to be remarked, however, that the chief of the modern offenders against the Smoke Prevention Acts are the town electric light stations, public and private. The unexpected truth is that in welcoming the electric light as they did, in the supposed interest of public health and the cleanliness of the town, our Metropolitan Local Authorities commited a huge mistake. We have always protested that the central electric lighting station was bound to be as great a nuisance, in its degree, as the old town gas-works, which had to be removed on this very account. Yet when the various Electric Lighting Companies began to carve up the City and West-End of London at their own sweet will—the Vestries looking on approvingly—nobody ever thought of inquiring what would happen to the neighbourhoods when the generating stations grew big. The magic of the electricians was over the public and the Local Authorites; and accordingly huge steam power factories were allowed to obtrude themselves into localities where no other kind of factory would have been admitted on any pretence. Steam power stations are the same, no matter what the application of the power may be. Engines thump and shake the ground, boiler chimneys pour out smoke, coal-carts rumble through the streets, ashes have to be carted away, and, in fine, a "nuisance" is the immediate product of every electric lighting station situated in a residential neighbourhood or fashionable quarter. The reason why the complaints of smoke are most bitter as against these establishments, is because of the magnitude of their steam-raising operations. The smallest electric lighting station in London is bigger than the biggest engine-house previously existing in the Metropolis, out of the East-End. Hundreds of horse power have to be generated in the heart of a quiet quarter; and in such a case the cost of fuel becomes a very important consideration. All the station managers are competing with one another in keeping down the works costs—a laudable aim enough; but unfortunately not capable of complete reconcilement with the purpose of the Smoke Abatement Acts. For as mechanical engineers know full well, and as Sir W. B. Richmond does not know, there is no saving in smokeless boiler firing, so far as the principle is involved.

An afternoon spent in an electric lighting station in the company of one of the amiable and accomplished gentlemen who are usually to be found at the post of duty in these establishments, would teach Sir W. B. Richmond more about the economics of steam-boiler firing than he will ever learn from disgusted observations of the Hammersmith chimneys from outside. That he should have allowed the "Daily News" interviewer to talk, without a check, about "chimneys consuming their own smoke," shows how little he has penetrated into the hard, stubborn facts. Smoke is an incidental result of the burning of a useful kind of coal in the particular way that the steam raiser for electric generating machinery often requires. He wants to get up steam quickly, and in large quantity; and boilers and fuel are adapted to answer the purpose. The coal burns with a long flame, which means smoke; but that is how the engineer wants it to burn. The smoke entails a loss of carbon at the rate of a few pounds weight per ton; but this is an inconsiderable trifle, from the steam raiser's point of view. It means a good deal, however, to the public outside; but that is their affair. The two interests are not reconcilable upon an economic basis.

This may appear a deplorable conclusion for the smoke abatement enthusiasts; but it is worse than useless to blink the truth. Recently, in Paris, the Municipality received the report of a Technical Commission appointed to investigate this very subject. Paris threatens to become almost as smoky a city as London, which would be a very dreadful circumstance. In the face of this eventuality, the Municipality decided to have the matter looked into. The question is the more urgent, since by reason of the complicity of the Municipality in the economical crime of keeping coal gas unnaturally dear, there is no prospect of the Paris Gas Company being able to do as much with prepayment meters as the London Gas Companies. Science and logic are strong points with the French; and it was quite in accordance with the national spirit that the question of the smoke nuisance in Paris should be referred to a Technical Commission, with instructions to find a remedy. The Commission began by offering prizes for the best smoke-preventing furnaces, for which there were 110 entries. Seven only of these belonged to the category of "gas producers and gas firing." All the furnaces were tried upon one and the same boiler, which was of the "elephant" type commonly used in France; and the same fuel—Anzin briquettes—was employed in every case. Every device was also tried by slow and by forced firing; and every test was made twice over—once by a stoker supplied by the manufacturer, and once by a man employed by the Commission. The tests included the determination of the quantity of fuel burnt per unit of grate area, the evaporation duty, and the observation of the smoke effect produced.

The latter proceeding is not an easy one to conduct upon a basis permitting of rigorous comparison of results. The Commission adopted for this purpose an ingenious method which was at least fair to all the devices tested. A smoke scale of five grades of intensity was decided upon; and charts prepared accordingly were mounted upon a drum driven by clockwork. The observer watched the chimney top, and pressed a pencil upon the moving paper at the degree, and during the period corresponding to the character of the smoke produced. The result was a diagram of which one dimension recorded smoke, and the other time. The area enclosed was measured by a planimeter, and its content taken as a measure of the smoke production of the particular furnace under observation. As the result of all the devices submitted for examination, representatives of three general types came out with a fair degree of credit. These were the Donnelly furnace (coking), the Proctor (mechanical stoker), and the Hawley (down-draught). Honourable mention was accorded to a steam-jet arrangement. This seems to register the high-water mark of the smokeless combustion, in a boiler furnace, of a naturally smoky fuel.

Experiments made for the purpose of furnishing a basis of

comparison, proved that the ordinary boiler furnace, with hand-firing, could not be worked without smoke, even with the most careful stoking. The next point to be established was that smoke prevention and fuel economy do not necessarily go together. The blackest of smoke represents an insignificant amount of fuel; and the tests demonstrated that the devices which produced the least smoke were not the most economical. Hence, the prevention of smoke must be paid for. The Commission reported that smoke may always be prevented by the use of coke for fuel; but they recognized the undesirability of legislating upon this narrow basis. They recommended the employment of other devices competent, with proper usage, to produce the minimum of smoke by depending upon the true principle, not of consuming smoke, but of preventing its production. Smoke once produced, as Sir Frederick Bramwell observed a long time ago, is unconsumable, incurable, and unmanageable in every way.

So the matter stands at this hour. No amount of enthusiasm engendered by the artistic temperament of Sir W. B. Richmond will eliminate the facts from the problem of smoke prevention. If a factory owner can afford the best Welsh smokeless steam coal, or has conveniences for burning coke or breeze, he can snap his fingers at the Smoke Inspector. Again, if his need of steam is fairly regular throughout the day, mechanical stoking will avail to burn a cheap, smoky coal for him without giving much cause for offence. But if he never knows from one minute to the next how much steam he will want; if at any moment he may require to stoke up "like mad" to overtake a sudden load—then flaming coal and a reeking chimney will be his only resource. And if the neighbours object overmuch, he will have to go elsewhere, for the necessity is imperative.

THE RUSSIAN MINERAL OIL SUPPLY.

Those who are interested in the market supply of mineral oil, may be recommended to procure the "Board of Trade Journal" for September, which contains a summary of a special report on the Russian petroleum industry by Mr. P. Stephens, H.M. Consul at Baku. It is one of the pressing practical and commercial questions of the day, as to what will be the effect upon the petroleum market of prospective legislation affecting the flash-point of burning oil. The mutual bearings of the American and Russian departments of the mineral oil trade will eventually determine this question. Nobody seems to know for certain the exact degree in which the Russian and American oil-fields will be able to compete with, or to assist each other. The difficulty of arriving at reliable information in this regard is aggravated by the circumstance that the standard unit universally adopted in the Russian oil trade is a weight—namely, the Russian pood of 36 English pounds—whereas in American oil statistics only volume or measurement is taken into account. It is a matter of impossibility to fix an absolutely constant ratio, or establish an exact equivalent between these two data, weight and volume, in the case of the mineral oil supply. This consideration may be commended to the notice of the enthusiasts who plead for the general adoption of the metric system as a complete means of facilita ting international trade.

The first thing that strikes one in perusing Mr. Stephens's report is the differences of character and quality that exist in the products of various Russian oil-fields. This variety presents a formidable obstacle to the determination of the value of the different oil-fields. Thus, while there is some petroleum got at Ilski, and more at Grosni, neither field is likely to compete seriously with that of Baku for some time to come, by reason of inherent defects of quality. As regards the Baku yield, it is difficult to assign any limit to it. There is any amount of oil at Baku; and the operations of the refineries are entirely regulated by commercial conditions and the relative market prices of kerosene, crude oil, and residuum. When the price of kerosene rules high, the output of this product is increased; whereas when the residuum (astatki) is valuable, the refineries do not separate so much kerosene from the crude oil. It is remarked as worthy of notice that the residuums of the Baku crude oil, whether after taking only an insignificant quantity of illuminating oil, or even only of benzine or gasoline, as well as after taking the maximum quantity of light and heavy kerosene, are in all instances suitable for fuel purposes. In the former case their flash-point is from 140° to 176° Fahr., and the specific gravity is below 0·900; while in the second, the flash-point may be from 316° to 366° Fahr., and the specific gravity about 0·915. Both grades are equally safe. Similarly, Baku crude oil yields good fuel oil without any refining at all; it being sufficient to allow it to stand a few days in open reservoirs for the benzine and gasoline to evaporate. This merely means the loss of from 5 to 10 per cent. of bulk.

The production of crude oil in the Baku district amounted last year to 55,375,000 barrels; this being a substantial increase upon previous years. The number of wells at work has grown very fast; but the stocks of raw material are at the present time very heavy, which points to a decline in the selling value of crude oil. This is an important matter. Mr. Stephens's judgment rests upon the fact that the stocks of crude are larger than they have ever been before; while the manufacturing centres of Russia are giving up the use of liquid oil fuel, and reverting to coal. It seems to be the quality of this oil fuel to figure as the stop-gap for coal. Some two or three years ago, Russian crude oil was to be had for a very low price; and all over the empire it was taken to in place of coal. Latterly, however, the value of crude oil has been steadily rising; so that it has already in many localities surpassed the relative value of coal. The capacity of the local storage receptacles is not great—being but 1 million barrels or so at the wells, and little over 3 million barrels at the refineries. This is not one month's production of crude oil. The pipe-lines which connect the oil territories with the refineries are of ample capacity. The local refineries do not appear to do a great business. Their number is diminishing, "because, notwithstanding the high price of residuum, the low price obtainable for illuminating oil makes refining unprofitable when taken in conjunction with existing prices of crude." Evidently, the carburetted water-gas interest must be adjusted to the situation.

PERSONAL.

On the occasion of the opening of the new retort-house at the Spalding Gas-Works, noticed in the "Journal" last week, the Gas Manager to the District Council (Mr. J. G. Hawkins), who planned the extension and superintended its carrying out, presented Alderman Mills (the Chairman of the Gas Committee) with a miniature set of stokers' tools in a case, as a memento of the occasion. They included a barrow, shovel, and rake, in silver; and the case bore a suitable inscription. Alderman Mills, in acknowledging the gift, said he should always associate it with a day when they gave a new impulse to one of the most successful undertakings in that part of the country.

On the occasion of his marriage, Mr. F. P. Tarrat, Manager at the Darlington Corporation Gas-Works, has been presented by the employees with a case of fish-carvers and a handsome leather dressing-case for his wife. The gifts were handed to Mr. Tarrat last Tuesday in the presence of a number of the subscribers. In the course of a little speech-making, it was mentioned that this was the first time a Manager of the works had been married while holding that position; and it was also shown that the utmost goodwill exists between the men and Mr. Tarrat. This gentleman acknowledged with gratitude the cordial manner in which the employees had testified to their regard; and he expressed the earnest hope that in the future the whole of the men would co-operate with him to secure successful working.

The Value of the Calorie.—Replying to the question on the above subject recently put by a correspondent of "Engineering" (*ante*, p. 1230), M. Sauvage says the two calories referred to are sometimes called *grande calorie* and *petite calorie*. For engineering purposes, the former only is used; and the name "calorie" alone is employed.

Professor Lewes on Acetylene.—At the Society of Arts last night, Professor Lewes delivered his third Cantor lecture on "Acetylene." On the preceding occasion, as will be seen by the report which appears elsewhere, he dealt with the production of calcium carbide. Last night he discoursed upon the commercial production of acetylene; describing the types of generators in use for the purpose, the actions taking place therein, and their effect upon the resulting gas. The lecture closed with some remarks upon the purification of acetylene for domestic consumption. At the last lecture, to be delivered next Monday evening, Professor Lewes will deal with the come bustion of acetylene, and its use for heating and motive power.

The Bacterial Treatment of Sewage.—At the meeting of the Society of Engineers last night, the paper read was by Mr. G. Thudichum, F.C.S.; his subject being "The Bacterial Treatment of Sewage." After describing the special uses of different processes, under varying local conditions of fall, and the nature of soil and sewage, the author gave in detail the method adopted at Worcester Park, where the Cheam and Cuddington sewage is received, to convert a process of precipitation and irrigation into one of bacteria-bed treatment and irrigation when desired—showing how the necessary beds were constructed by excavation, and filled with burnt ballast produced on the farm, at a total cost of about £325. The quantity of sewage to be dealt with amounts to about 80,000 gallons daily in dry weather. The conversion of the Sutton sewage works was also alluded to; the cost there having been something less than £2000 for a daily flow of 500,000 gallons of sewage, while the saving in working expenses was £500 per annum. The author also dealt with the problem of sewage treatment as applied to hospitals, schools, country houses, and other small communities. Alternative methods were described, and some particulars were given concerning a recent installation at a large public school. In conclusion, he pointed out that all the statements made on the occasion of his paper read in 1896 before the Society of Engineers still remained good; that knowledge had greatly increased during the past two years, but without altering—only extending—the ideas entertained at the date of his paper, as a result principally of the Barking experiments; and that the correctness of the particular method of working, by alternate filling and emptying, was confirmed by all later experiments.

NOTES.

The Lighting of Class-Rooms.

The deleterious effects of badly-lighted class-rooms on the eyesight of students has been pretty generally acknowledged; and it is not going too far to say that to this cause is attributable much of the myopia existing among young people at the present day. Mr. Brudenell Carter—probably the greatest authority on children's eyesight in this country—dealt with this matter fully in a paper he read before the Society of Arts some months ago; and the question has forced itself upon superintendents of educational establishments at home and abroad. About two years since, Dr. Dargelos, Chief Medical Officer at the Lycée at Aix, placed on record the opinion that the eye troubles, headaches, and general discomfort experienced by the scholars, especially when studying in the evening, were attributable to bad—that is to say, to badly distributed—lights. The remedy was found in the adoption of diffused lighting by means of well-placed incandescent gas-lights, whitened walls and ceilings, and reversed shades. At the Lycée at Troyes, where an installation has been carried out by M. Laurain, the Manager of the gas-works, a saving of about 18 cubic feet of gas per hour per study has been effected. The results have recently been published of some trials carried out at the College and in the Municipal Drawing School at Fontainebleau, by M. Vallée, the Superintending Architect of the town. At the College, seven Bengel burners, each consuming 12 cubic feet of gas per hour, were replaced by four Welsbach burners (No. 2), passing only 4 cubic feet each. In the Drawing School, 13 gas-burners, each consuming more than 14 cubic feet per hour, were replaced by seven Welsbach burners (No. 3), each using 5 cubic feet only. In both cases the light has been at least doubled by the change, no shadows are thrown, and the illumination is perfectly satisfactory to the scholars. The lamps are lighted by electricity, which somewhat increased the expense of first establishment; but this method need not necessarily be adopted.

The Use of Water Gas in Metallurgy.

Mention has been made in the "JOURNAL" of the remarkable experiments of Dr. Ludwig Mond on the action of carbonic oxide gas upon nickel. These showed that, whereas carbonic oxide is not completely dissociated by heat alone even at the high temperature of 1690° C., in the presence of nickel the removal of carbon from the gas begins at 350° C. The gas carried forward portions of the metal, and in consequence burnt with a luminous flame. Nickel carbonyl was then isolated in a liquid state, and was produced with facility in any desired quantity. No other metals investigated showed indications of combining directly with carbonic oxide gas, except iron. The fact that iron would do so, had already been demonstrated in an unpleasant manner in connection with the working of carburetted water-gas plant. The subject of the iron and nickel carbonyls has been further investigated by Dr. Mond; and a paper on the subject was recently read by Professor Roberts-Austen before the Institution of Civil Engineers. It revealed the possibilities of water-gas plant in metallurgy. Water gas has been used for this purpose at Smethwick since 1892. The process is the production of metallic nickel from "Bessemerized matte." Incidentally, the hydrogen of the water gas is used to reduce some of the copper of the matter to the metallic state, which is effected in towers maintained at a temperature not exceeding 300° C. From this tower, the mineral passes to another, at a temperature of 100° C., where the carbonic oxide of the water gas takes up part of the nickel in the form of the compound nickel carbonyl. This gaseous product is carried on to a retort heated to 180° C., where the metallic nickel is thrown down. The carbonic oxide returns to take up a fresh charge of nickel. Thus when the operation is in full swing, the gaseous carbon monoxide and the partially reduced oxide of nickel and copper continuously revolve in opposite directions, in two separate circuits, which join and cross each other in the volatilizer. This is up to the present time the only industrial application of water gas other than for lighting purposes.

Engineers and Architects.

Speaking in Birmingham to the members of the Municipal Technical School Engineering Society, the President, Mr. G. Fuhrmann Clarke, dwelt upon the much-debated question of the desirability of engineering works being decorated by what are intended to be beautifying details. He strongly advised engineers to cut themselves free from all preconceived notions of architectural effect; pointing out that engineering designs, and most engineering materials, are not to be improved by the sticking on of architectural adornment. He denied the assertion of an eminent architect that the practical training through which engineers pass in foundries and workshops is chargeable with the destruction of any powers of perception of the beautiful which they might otherwise have possessed. As a matter of fact, three of the most beautiful monumental engineering works in England—the Menai Suspension Bridge, and the Waterloo and London Bridges—are works of men who rose from the ranks of labour. In allusion to the Forth Bridge, which he characterized as the finest example of modern bridge design, Mr. Clarke pointed out that this result was due to the entire freedom of the work from architectural embellishment. The same eminent architectural opinion already alluded to has condemned the appearance of the Forth Bridge; but this judgment Mr. Clarke dismisses as due to the same want of perception which engineers are blamed for not possessing. It is to be remarked upon this subject that the modern practice of abandoning, in respect of such structures as gasholders, those attempts at architectural adornments to which gas engineers of the last generation were so much addicted, should be counted to the younger constructors for righteousness. East Greenwich and New Beckton are to be set off in this respect against Fulham. If, however, gas engineers cease to vex the souls of architects in regard to "ornamenting" their gasholders, the architects ought to acknowledge the obligation by not leaving street lamp-posts to the foundry pattern maker, and interior house-fittings to the piece-work brass finisher.

Wind Velocity and Rainfall in the Barbados Hurricane.

Most of our readers will doubtless remember the accounts that reached this country of the hurricane which visited Barbados on the 10th of September last. By the courtesy of the Observer of the United States Weather Bureau on the island (Mr. P. M'Donough), some extracts from the journal entries for the three days during which the hurricane prevailed were furnished to Mr. J. Harger Pye, the Engineer and Manager of the Barbados Gas-Works, who has forwarded copies to us. Interesting particulars are given in regard to the rainfall; but, unfortunately, there is no record of the intensity of the wind pressure—the weather vane used only registering the average velocity during certain short intervals of time, and not that of the heavy gusts which did so much damage. Rain began to fall at 1.15 p.m. on the 10th. During the afternoon, the wind was generally north, but without any decided increase of force. At 6.10 p.m., however, it changed to north-east, with increased velocity; and half-an-hour later it was blowing a gale which grew stronger every minute. At 10.18 p.m. it had attained such velocity that it blew down the wind-vane and the anemometer support. During the storm there were terrific instantaneous gusts, the velocities of which must have been very great. At 5 p.m., the wind was going at the rate of 13 miles an hour, or equal to 0·96 lb. per square foot; at 6 p.m., 17 miles, or 1·60 lbs.; at 7 p.m., 31 miles, or 4·92 lbs.; at 8 p.m., 36 miles, or 6·48 lbs.; at 9 p.m., 43 miles, or 9·30 lbs.; at 10 p.m., 54 miles, or 15·65 lbs. The greatest velocity in five minutes (10.1 to 10.6 p.m.) was 62 miles per hour, or equal to 19·80 lbs. per square foot—the direction of the wind being north-east; and the highest for one minute was 75 miles per hour, or 28·51 lbs. per square foot. The velocity was much greater between 10.18 p.m. and midnight than at any previous time, and must have attained from 90 to 100 miles an hour; 95 miles being equal to 45 lbs. per square foot. The wind abated considerably after midnight, but a strong gale blew until after the morning observations were taken on the 11th. The fluctuation in the pressure of gas upon the delivery mains was about 7-10ths. Mr. Pye thinks that the fluctuation on the outlet from the holder must have been much more; but this was not noted at the time. The total rainfall from 6 p.m. on the 10th to 10.30 a.m. on the 12th was 11·42 inches; reaching, it is reported, as much as 22 inches in the country districts.

COMMUNICATED ARTICLE.

SLOT COOKERS AND ALL ABOUT THEM.

By E. W. T. RICHMOND.

CONCLUDING ARTICLE.

"Let me have time and counsel for my cause."
—"Henry VIII.," iii., 1.

1898.

We are now close upon the heels of passing events; and it is gratifying to note the progress that "slot cookers" have made this year.

"I will tell you everything right as it fell out."

BRENTFORD BUMPERS. 40 PER CENT. INCREASE.

I have referred previously to the prominent position occupied by the Brentford Gas Company as pioneers in fixing slot cookers. Their prepayment consumers grumbled (and rightly too) at having to pay a higher rate for gas and also a stove rental; and the Board, advised by Mr. Husband, wisely abolished them. They are now reaping their reward, as witnessed by the addresses of the Chairman Mr. H. C. Ward) in February and August of this year. "The sale of gas through the prepayment meters had been extraordinary." "1897 showed a growth over 1896 of 40 per cent.—8157 being in use in 1896, and 11,421 in 1897." It is worth while to pause and compare this sanguine statement with the regrets expressed at Manchester, Edinburgh, Scarborough, &c., as to low consumptions—Brentford with cookers fixed free gets more than double the average consumption of Scarborough, and treble the average automatic consumptions of Edinburgh and Manchester. Surely the advantage of free cookers is too manifest to be longer disregarded. Brentford depreciates drastically—automatic meters, 15 per cent. per annum; stoves, 12½ per cent. per annum; fittings, 15 per cent. per annum. The effect of this is seen in that, although the last ten years the Company's capital

has grown 35 per cent., its business has increased 70 per cent. Mr. Ward says, under date Oct. 21, 1898, after a cordial reference to the articles: "I fully believe the slot meter system has opened to gas companies a large source of business and revenue that laid dormant before the introduction of the 'slot.' Our experience at Brentford is quite in their favour. I see you talk of our (Brentford) dealing with the depreciation being '*drastic*.' I am glad to see the remark. I am sure of the wisdom of writing off depreciation from meters, 'slots,' and stoves very liberally. It will put the companies who do so in a strong position in the future."

Mr. R. Beynon, of Torquay, finds room, in his original and practical Presidential Address to the Southern District Association in February, to record the result of one year's working as averaging 9000 cubic feet per annum—not enough; and wisely he has at once remedied the defect, and added a 12-inch oven cooker at, however, unfortunately, a small rental, which with 1s. 2d. per 1000 cubic feet extra one considers rather heavy. Doubtless, having gone so far, Mr. Beynon will induce his Board to complete the journey, and abolish rentals.

Mr. R. Beynon, Torquay.

This year witnesses the abolition of rentals of all stoves up to and including 6d. per quarter by the Leicester Corporation. The remarkable results obtained by Mr. Alfred Colson throughout his management at Leicester are perhaps best known to the general public by his efforts, commencing fifteen years ago, and continued ever since—in season and out of season—to promote gas cooking, and resulting in more than 10,000 cookers being supplied to 30,000 ordinary consumers (the balance of 5000 consumers being works, shops, and duplicate meters). We all remember his little standard pamphlet, "Economy and other Advantages of Cooking by Gas," and the hundreds of thousands of copies printed and circulated in various parts of the country and abroad. It is certainly promising and gratifying to find Mr. Colson coming into the "free fold," if only as far as 6d. a quarter for cookers, which are fixed with slot meters. (Prepayment meters were introduced here in 1893.) I remarked to Mr. Colson "this will prove the thin end of the wedge, and result in your fixing all slot cookers free." This is what he anticipates without fear or regret. The necessity of abolishing rentals as regards slot cookers was evident, as, although there were 8000 slot meters in use in Leicester, only one in ten had cookers up to June, 1898—since October, 1898 (three months) increased to one in five. This concession will certainly bring slot cookers up to the same proportion as ordinary consumers—viz., one stove to three consumers—and should easily reach three stoves to four consumers, especially as the extra charge is only 5d. per 1000 cubic feet—30 cubic feet being supplied for 1d. Writing on the 24th ult., Mr. Colson informed me that he was connecting 80 cookers weekly.

Mr. Alfred Colson, Leicester.

One gladly welcomes from Warrington the most complete table of provincial automatic results yet published. It is given in Mr. W. S. Haddock's Inaugural Address to the Manchester District Institution of Gas Engineers last February. The table is a mine of information which I have analyzed, and extracted therefrom the following figures and inferences. I am not able to name the towns, as they are referred to by numbers.* Out of 80 Provincial Gas Departments tabulated, two do not reply as to what they supply free besides meter-fixing; but out of the remaining 78, 69 confirm my contention that "liberality pays." The remaining nine are divided into groups of ones and twos of differing customs, from which no reliable data can be obtained. There are 27 departments *fixing meters and giving services free*. Their consumption averages **7174** cubic feet per annum. There are six departments *fixing meters and giving services, pipes, and fittings free*. Their consumption averages **7745** cubic feet. Finally, we have 29 departments *fixing meters and giving services, pipes, fittings, and boiling-burners*. They average **8711** cubic feet. (None are shown as fixing cookers free as yet; but I note that three departments give from 2 to 4 cubic feet extra per penny for gas-cooking.)

Mr. W. S. Haddock, Warrington.

Table Tells Liberality Pays.

The lesson to be drawn from this table is invaluable. The average consumption with meter-fixing and services free is **7174** cubic feet; but with fittings and a boiling-burner added they increase **1537** cubic feet, besides obtaining by this means a much larger proportion of consumers. Is it not fair to assume that cookers fitted free would increase this total at least another 6000 to 8000 cubic feet, as several companies get 12,000 cubic feet from stoves alone?

Another very interesting set of deductions may be made—as to the extra amount charged, and the effect of price on consumption. The average extra charge of the 80 departments is 7½d. per 1000 cubic feet; varying from 2d. (in three cases) to 13d. (in two cases). As regards the number of feet for 1d., they vary from 15 cubic feet (one case), with a consumption of 6500 feet, to 33 cubic feet, with a consumption of 8500 feet (one case—Widnes, I believe—since increased to 36 feet).

Twenty-three works (nearly one-third of the total table) give 25 cubic feet for 1d., with an average consumption of **8296** cubic feet. The next in importance are those giving 20 cubic feet for 1d. (twelve cases), with an average of **6062** cubic feet. Then we have seven departments giving 22 cubic feet for 1d., averaging **9288** cubic feet; and six departments giving 28 cubic feet, averaging **9510** cubic feet. The remainder are two, three, and four series of cases, with consumptions of **9114** cubic feet at 30 feet for 1d. to **6100** cubic feet with 17 feet for 1d.; from which it would be unwise to deduce any definite ideas. The safest bases are the 25 and 20 cubic feet for 1d. results, as these two account for one-half the table. Here we have 25 feet for 1d. consumers averaging **8296** cubic feet, against the **6062** cubic feet average of the 20 feet for 1d. users.

These figures are gathered chiefly from the works under the control of members of the Manchester District Institution. It would be interesting to obtain comprehensive figures throughout the country, and analyze them. There can be little doubt, however, as to their showing much the same results, viz.—

The Moral.

1.—The cheaper the gas, the more is burned.

2.—The greater facilities offered for using gas, particularly with free stoves, the greater the consumption.

The appetite grows with what it feeds upon; and, in spite of the already enormous quantity of slot cookers lent free by The Gaslight and Coke Company, Colonel Makins speaks of 12,000 additional automatic cookers fixed during the last six months of 1897. Free grillers were at this date decided upon for Salford and Blackpool. A typical Town Council discussion followed the Gas Committee's proposal at the latter place. "Ironmongers and plumbers would be injured by it," said one gentleman; but he only found one supporter. The majority, looking upon "the greatest good for the greatest number" as their corporate aim, suggested that cookers too might follow. If the profits to be thus derived were only duly appreciated by the Council, they speedily would be so supplied.

The Gaslight and Coke Company Fixes Another 12,000 Cookers.

Salford and Blackpool.

Huddersfield, in harmony with Hull, Leeds, and the other go-ahead towns, on the advice of the Gas Committee and the approval of the Council, decided from April, 1898, to suppply cookers free with slot meters, since which time automatic applications and consumptions have greatly increased. Huddersfield gives 30 cubic feet of gas for a penny.

Huddersfield Harman—izes [Harmonizes].

Let us now for a brief moment glance again at the progress made in the United States. Ordinary cooking stoves, it is estimated, are being fixed at the rate of 100,000 per annum—more, I should estimate, than England is doing; but in automatic meters, with or without cookers attached, it is wofully behind. One company has 30,000 out; and the rest are simply nowhere—15,000 among the remaining fourteen gas companies who have adopted the system, being the estimated grand total up to Midsummer, 1898.

What of America?

In New York, the landlords are applying for them on account of the increased applications from tenants for houses thus supplied. A similar experience was related to the writer by Mr. G. F. L. Foulger, who found, during The Gaslight and Coke Company's partial suspension of the system in 1895 (owing to non-deliveries of meters) that landlords were charging 3d. and 6d. per week extra for houses fitted up with the automatic installation.

Mr. G. F. L. Foulger and London Landlords.

Mr. Andrew Wilson, of Perth, who read his father's paper in 1897 at the North British Association meeting, this year gives his own experiences; and, as would be expected from one of the younger generation, he considers excessive his department's charge of 1s. per 1000 cubic feet extra, and desires to see a griller fixed free with every meter. When a Gas Department gets thus far, there is reason to hope they will be moved by their own interest and their customers' needs to supply a really useful cooker. The discussion on the paper, in which Mr. R. S. Carlow, Mr. T. W. Ward, Mr. J. Ballantyne, and the President (Mr. T. Wilson) took part, became, as usual now, a chorus of praise; but there was no mention of anything beyond a boiling-ring as an auxiliary to the night and winter consumption.

Mr. A. Wilson, Perth.

In August, the North of Ireland Association, after seven years, again give prominence to prepayment meters through a paper read by Mr. R. Ross, of Dungannon, who has in just over nine months fixed more than 120. This is a very good showing for a small works (7½ millions), and possibly the best results, for its size, in Ireland; and deservedly so, as Mr. Ross has dared to do what some American Engineers have recommended, but no English Engineer I know of has yet attempted—viz., given half a cubic foot *more* per 100 feet to prepayment meters than to ordinary ones, besides fitting up brackets and piping to the value of 30s., as well as fitters' time. The writer would urge the consideration of a similar proceeding on small companies whose charge for gas is 4s. or more per 1000 cubic feet. In Mr. Ross's case, it was 5s. 10d.; and he gave 15 cubic feet for 1d. The cost of fittings might be placed to a suspense account, and liquidated out of general profits at a liberal rate.

Mr. R. Ross, Dungannon, after Seven Years.

* The table referred to will be found in the "JOURNAL" for March 1, 1898, p. 470.

MR. G. R. LOVE, DUNDALK.

Mr. G. R. Love, of Dundalk, dealt very severely with Mr. Ross's generosity. He approves of slot meters, but not free accessories; but the best proof of the soundness of this plan is the fact that the latter gentleman, with a much smaller town—the population being 4000, against 14,308 in Dundalk—has got out more than 100 meters in nine months, while Mr. Love has been three years getting out the same number. Mr. Love supplies cookers with separate prepayment services, and makes a reduction of 7½d.; so that he succeeds so far as he is liberal.

I have dealt thus in detail with these smaller companies, believing that the field as yet unexplored by them is even larger proportionately than is the case with the larger towns with cheap cottage property already fitted up with gas, and consequently having many two and three light meter consumers.

The discussion on Mr. Ross's paper elicited the fact that Mr. Whimster, of Armagh, has not yet decided to supply either lights or stove, and consequently had not done so much as he felt to be possible, and that Messrs. T. Frizelle (Holywood), E. Stears (Lisburn), and A. Gibb (Newry) all agreed as to their satisfactory experiences of the system; but, not having cookers attached, they had small consumptions.

Once again, and this for the last time, we are face to face with the remarkable figures of The Gaslight and Coke and South Metropolitan Companies. Their respective figures to June 30, 1898, are:—

	Automatic Meters.	Stoves.	Approximate Annual Value of Cooker Consumption.
Gaslight and Coke . .	90,000 ..	72,000 ..	£90,000
South Metropolitan. .	72,300 ..	57,000 ..	71,250

This is reckoned at the rate of £1 5s. per stove. The Brentford Gas Company have to the same date reached the highly satisfactory figures of 13,300 automatic meters and 11,280 cookers.

HOUSES SUPPLIED WITH SLOT COOKERS BY THE LEICESTER CORPORATION GAS DEPARTMENT.

NUMBER OF SLOT COOKERS FIXED BY THE DEPARTMENT IN USE ON NOV. 24, OVER 2000.

BETTER-CLASS HOUSES, AVON STREET, LEICESTER.

Average rentals per week	7s. 6d.
Number of cubic feet of gas for 1d..	30
Extra charge per 1000 cubic feet to prepayment consumers	5d.
Average annual consumption	10,000 c. ft.

CHEAPER-CLASS HOUSES, EASTBOURNE ROAD, LEICESTER.

Average rentals per week.	5s. 6d.
Average annual consumption.	5000 c. ft.

HOUSES SUPPLIED WITH SLOT COOKERS BY THE DORKING GAS COMPANY.

NUMBER OF SLOT COOKERS FIXED BY THE COMPANY, 100.

BETTER-CLASS HOUSES, WATHEN ROAD, DORKING.

Rentals per week	10s.
Number of cubic feet of gas for 1d.	20
Extra charge per 1000 cubic feet to prepayment consumers .	8d.

CHEAPER-CLASS HOUSES, ANSELL ROAD, DORKING.

Rentals per week	5s. 6d.

Mr. G. F. L. Foulger, who has, from the first, agreed with the necessity of supplying a slot cooker with every installation, tells me that 82 per cent. of their slot consumers are now using cookers, and that the cooker doubles the consumption. The few consumers who have only fittings (wisely provided with 4 and 5 cubic feet governor burners) and a boiling-burner use but half the gas of those supplied with a cooking-stove in addition. We must not lose sight of the fact that this testimony is of the very highest value, based upon the most extensive use of cookers in this country; and it means that the deductions drawn from the figures I extracted from Mr. Haddock's table (giving an average of 8711 cubic feet for those companies who supplied a meter, service piping, fittings, and boiling-burner free) may now be regarded as convincingly proved. The 8000 cubic feet increased consumption claimed throughout this paper as the result of a good-sized cooker (not less than 12 inches square) is, therefore, well within the mark.

MR. G. F. L. FOULGER AND SLOT COOKER CONSUMPTION.

TOTTENHAM TOTALS.

Mr. Corbet Woodall stated at the Tottenham and Edmonton bi-annual meeting (September, 1898) that there had been an increase of 30 per cent. over 1897 totals (see Article No. 2, *ante*, p. 1162). "The Directors were completely satisfied with the working of the system. Those who discontinued it were very few indeed; and this might be taken as a proof that the users highly appreciated it. The Directors would do their utmost to extend the use of the slot meter in the district; and it was in their favour that the houses to be so dealt with were numerous—a comparatively large field yet remained uncovered."

By a coincidence, my own town of Romford witnesses my final public reference. I refer to the admirable address of Mr. W. D. Child to the Eastern Counties Gas Association on the 15th of September last. No comprehensive survey of the present prospects of the gas industry could now be complete without reference to the prepayment system. Mr. Child is, as usual, most careful to feel his way; and at present he has only

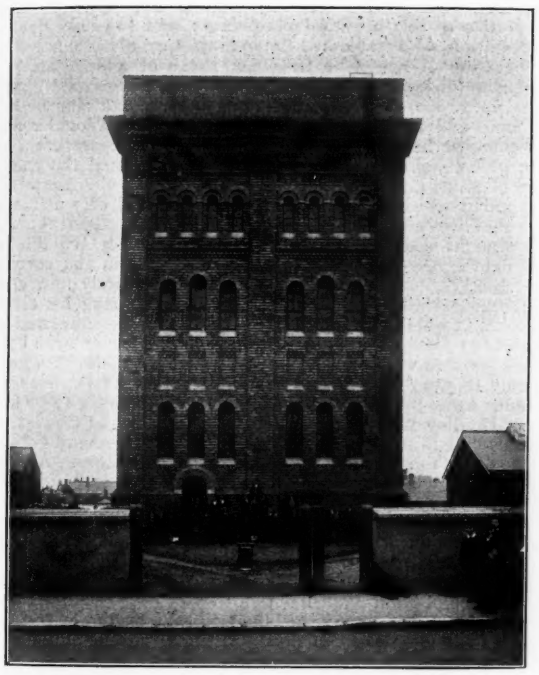
MR. W. D. CHILD, ROMFORD.

got as far as a free boiling-burner or griller. In addition, however, cookers are supplied on a rental, with a charge for fitting. The best proof that this lack of liberality does not pay, is the acknowledgment that only a few consumers—162—are supplied after two years. With cookers free, I believe Romford, and all companies adopting similar conservative lines, might *double their automatic consumers*, and increase the consumption of those already supplied, by fixing cookers with every meter. Ample justification for this statement may be found in these articles.

PLYMOUTH, BOURNEMOUTH, AND CAMBRIDGE.

The Plymouth, Bournemouth, and Cambridge Gas Companies have within the last few weeks decided to fix cookers free; and indeed will not put in the installation without a stove; and the example of Swindon, following Mr. S. Glover's successful lead at St. Helens, to whom I must "give the benefit of seniority," ought not to be overlooked—500 cookers, the smallest 12 inches square, and the largest 14 inches, being fixed during the last twelve months. Mr. J. J. Jervis, after carefully considering the advantages of an increased cooker consumption, decided to advise his Board to supply boiling-burners free, and to reduce cooker rents to 2d. and 4d. per month. He wisely recommends a good-sized one, of the best grade, too—the oven preferably 13 inch by 13 inch—with three boiling-burners and a griller; and he assures me that the results are all he could desire, and are more than he expected from the classes supplied. The Swindon slot meters are cleared monthly; and, indeed, I may remark in passing, during the last five years

MR. S. GLOVER, ST. HELENS, AND MR. J. JERVIS, SWINDON.



BOURNEMOUTH GAS AND WATER COMPANY'S AUTOMATIC INSTALLATION WORKSHOP AND CONTRACTORS' STAFF AT DINNER HOUR.

HOUSES FITTED WITH SLOT COOKERS BY THE BOURNEMOUTH GAS AND WATER COMPANY.

BETTER-CLASS HOUSES, WINDSOR ROAD, BOURNEMOUTH.

Rentals per annum	£25 to £30
Number of cubic feet of gas for 1d.	20
Extra charge per 1000 feet to prepayment consumers.	8d.

HOUSES SUPPLIED WITH SLOT COOKERS BY THE PLYMOUTH AND STONEHOUSE GAS COMPANY.

NUMBER OF SLOT COOKERS FITTED, OVER 1100.

BETTER-CLASS HOUSES, FLORENCE VILLAS, CATTEDOWN ROAD, PLYMOUTH.

[TENEMENT HOUSES.]

Rentals average per week about	5s.
Number of cubic feet of gas for 1d.	25

CHEAPER-CLASS HOUSES, EDGECUMBE PLACE, WEST HOE ROAD, PLYMOUTH.

Weekly rentals per tenement	3s. 6d.

the ordinary meters also have been read and accounts collected monthly. Truly—

"Must poor matters point to rich ends."

Thus we might trace, in town after town, the fact that the slot meter has opened up a marvellous field for day *equally with night* consumption. We may justly say:

"Upon my life, it will do wondrous well."

MR. W. MEDHURST, FOLKESTONE.

The Folkestone Gas Company have decided that cookers are a necessary part of an automatic installation, and are adopting them. Mr. Medhurst has hit upon a very happy idea for interesting his consumers in keeping their cookers clean. He purposes giving prizes every Christmas for the best-kept stove—one prize to every 50 cookers. The prizes will be of an average value of 10s., to be invested in joints, grocery, &c.,—an admirable plan, and one which is worthy of emulation.

MR. R. O. PATERSON, CHELTENHAM.

These articles would not be complete without a reference to the strides made by Cheltenham. They commenced fixing coin meters in 1896; and besides putting in piping, two pendants, and two brackets, they gave a boiling-ring attached with flexible tube. By the end of 1896, they had fixed 457 meters. An inquiry or two for a small cooker came to Mr. Paterson's knowledge early in 1897; and before the end of the year, they had 446 cookers out on hire at 1d. per week. They have now abolished this hiring charge altogether, and fix the cooker free as part of the coin-meter fittings. In the concluding part of a letter from Mr. Paterson under date Dec. 2, 1898, he says: "The thing is not half done if a cooker is not supplied to every house."

1888 TO 1898.

The years from 1888 to 1898 have, I venture to say, been the most eventful of this completed century of gas manufacture. They have witnessed a transformation in the very foundation of our friendly flame. Water gas is but beginning its career; and what coal is carbonized will be shot instead of shovelled. The twin fairies of Science and Invention have indeed dwelt among us. The

Welsbach incandescent light bids fair to stem the tide of eccentric electricity; and when we get burners at 1s. each, as on the Continent, instead of 5s., and mantles at 3d., it may be introduced into every house. Then the electric tide will slowly ebb. But surely no breakwater was ever so well erected as our last gift from the gods—the popular slot system. Introduced without parade, at first flouted, but finally fostered, it has almost imperceptibly grown into the life-blood of our distributing departments.

MAKING HISTORY. When the social history of the nineteenth century comes to be written, gas for lighting, and latterly for heating, cooking, and motive power must bulk largely in it. But it has remained unto these latter days, with its supply from the works to the burner and the stove at an inclusive charge, to number our working classes among its clients, and thus crown the efforts of those who have gone before.

ASSISTANCE ACKNOWLEDGMENTS. This survey of the initiation and development of this important departure, as revealed in published references, from particulars supplied by various professional friends (most of them mentioned in the text) is complete. My sincere thanks and acknowledgments are due to these gentlemen for the assistance rendered; and if my humble efforts should result in inducing some Gas Departments to keep their extra charges below 10d. per 1000 cubic feet, and where less than 20 cubic feet for 1d. are given to charge little if any extra, and develop their consumption by fixing good-sized cookers absolutely free, I shall be well repaid, and they will not regret following me to this

"Last scene of all,
That ends this strange eventful history."
"As You Like It," Act ii., Sc. 7.

Private Bills in Parliament.—Last Wednesday the time expired for depositing at the Private Bill Office, Westminster, and elsewhere, plans and other documents in connection with Private Bills to be proceeded with during the ensuing session. The plans deposited numbered 363, made up as follows: Railways, 58; Tramways, 14; Miscellaneous, 102; General Provisional Orders, 75; and Electric Lighting Orders, 114. The deposits on the corresponding day of last year for the session of 1898 were: Railways, 61; Tramways, 15; Miscellaneous, 86; General Provisional Orders, 85; Electric Lighting Orders, 85—total, 332.

Acetylene Gas for Railway Carriage Lighting.—The use of acetylene gas for lighting trains on the Cape Government railways does not appear to have been attended with success. An experimental plant was fitted to a composite bogie saloon, running on the Eastern system of the railways; but, after a trial, it was removed. The all-pervading odour of the gas was objected to; and the tendency to clog the burners was found to be a serious difficulty. There would seem, nevertheless, to be an opening for an improved means of lighting the railway trains in South Africa. The lighting of those on the main line, we are told, "leaves everything to be desired."

Large Water-Meters.—Three large water-meters have been ordered by the Street and Water Commissioners of Jersey City, U.S.A., to measure the supply purchased by the city from the East Jersey Water Company. One is a 20-inch size, and two are for 36-inch pipes. They are provided with spigot ends on both inlet and outlet pipes, so that either bell-end valves or the regular water-mains can be connected at each end, as may be desired. When in place, they form part of the mains, and the shells need not be disturbed to remove the working parts. The latter are made of bronze, and consist of a cylinder in which there is a propeller rotated by the flow of water, and the train of gears to transmit the motion to the register. The propeller has Tobin bronze blades, and is carried on a ball bearing. An extra large screen is provided, and has a flanged opening for a gate-valve, through which the intercepted sediment and *débris* may be blown out.

Mineral Resources of the Philippines.—The American papers publish a report forwarded to the United States Geological Survey by Mr. G. F. Beeker, who has visited the Philippine Islands to ascertain their mineral resources. So far as is definitely known, he says the coal of the Philippine Islands is all of the tertiary age, and might better be characterized as a highly carbonized lignite. It is analogous to the Japanese coal and to that of Washington, but not to the Welsh or Pennsylvania coal. Such lignites usually contain considerable combined water (8 to 18 per cent.), and bear transportation badly. Coal exists in various provinces of the Island of Luzon; and a number of concessions for mining have been granted. Many of the other islands contain coal, and in the great island of Mindanao it is known to occur at eight different localities. In the island of Cebu, petroleum has been found associated with coal at Toledo, on the west coast, where a concession has been granted. It is also reported from Asturias, to the north of Toledo on the same coast, and from Alegria, to the south. Natural gas is said to exist in the Cebu coalfields. On Panay, too, oil is reported at Janinay, in the province of Iloilo; and gas is reported from the same island. Petroleum highly charged with paraffin is also found on Leyte, at a point about four miles from Villaba, a town on the west coast.

TECHNICAL RECORD.

ACETYLENE.

By VIVIAN B. LEWES, F.I.C., F.C.S.,
Chief Superintending Gas Examiner to the Corporation of London, Professor of Chemistry at the Royal Naval College, Greenwich.

[The Second of a Course of Cantor Lectures at the Society of Arts, delivered Nov. 28, 1898.]

In my last lecture, I pointed out that Edmund Davy first made acetylene from a compound produced during the manufacture of potassium from potassic tartrate and charcoal, which, under certain circumstances, yielded a black compound decomposed by water with considerable violence and the evolution of acetylene gas. This compound was afterwards fully investigated by Berzelius, who showed it to be carbide of potassium, and who also made the corresponding sodium compound, and showed that it evolved the same gas; while in 1862 Woehler first made carbide of calcium, and found that water decomposed it into lime and acetylene.

During the past few years, a wordy war has raged as to whether the discovery of the processes by which calcic carbide is now produced is due to the French chemist Moissan or the Canadian experimentalist Willson; and many still seem to imagine that it is the discovery of calcic carbide and acetylene that is in question. In point of fact, our knowledge has advanced but little, save in details, since the labours of Davy, Woehler, and Berthelot clearly defined the preparation and properties of this beautiful illuminant; and the only question in dispute is, who translated the manufacture of carbide and the preparation of acetylene from the ranks of a laboratory experiment (of mere scientific interest) to a commercial success. Carron, in 1860, obtained an alloy of calcium and zinc by heating lime and zinc to a high temperature; and Woehler made his calcic carbide by heating to a very high temperature a mixture of lime, zinc, and carbon, which first formed the calcium zinc alloy, and then carbide; the zinc being volatilized. The compound which he obtained was impure, and very unlike the beautiful crystalline substance obtained at the present time.

It was Sir Humphrey Davy who first demonstrated the heat and light of the electric arc; and it was late in the seventies that Sir William Siemens inaugurated an entirely new era in experimental and metallurgical work, by patenting his electric furnace, in which the electrical energy could be converted into heat, thus yielding a temperature which had never been before available, and which has been estimated by Violle as approximating to 3500° C. As gradually the utility of the electrical furnace came to be recognized, other patents began to be taken out. Bradley patented a furnace in 1883; while Cowles took out his patent in 1885, and in 1886 patented a lining of lime and carbon for the furnace, as being more refractory. Although these furnaces were used for making aluminium, large quantities of carbide of calcium were accidentally formed by the action of the heat on the furnace lining; and during 1886 and 1887 the lads employed in the works used often to amuse themselves in the dinner hour by putting water on the old crucible linings, and igniting the gas which was set free. Even before that date it was recognized and published that in the Cowles electric furnace the oxides, not only of the alkaline metals, but of calcium, magnesium, aluminium, silicon, and boron could be reduced in the presence of carbon, and could be made to form alloys with other metals present, while with aluminium and other metals the crystalline compound made with carbon could be obtained; and further that silicon and the compound of silicon with carbon could be produced. It is clear, therefore, that as early as 1886 calcic carbide was made in the electric furnace; but its formation was merely accidental, and no commercial importance was attached to it.

Soon after this date, Willson conceived the idea of reducing aluminium in the presence of copper to make aluminium bronze; and he employed practically the same method as that used by Cowles. But as his attempts to make the bronze were not successful, and as he was unable to make aluminium owing to the Cowles patents, he endeavoured to reduce magnesium and calcium to the metallic state. It was in the spring of 1892 that he attempted to reduce lime by carbon; and he found that he obtained by this means a fused bath, the boiling of which caused the short circuiting of the electric arc. In order to prevent this spitting of the liquid, and the unequal loading of the dynamo which interfered seriously with the working of the machinery and water turbines, he added to it carbon, which prevented the splashing of the liquid against the sides of the electrode; the only portion of the surface exposed being in the immediate path of the arc.

It was in May of 1892 that carbide was obtained by Willson in quantity, and samples were forwarded by him to various scientific friends in America; and it was on Sept. 16 of that year that he privately sent specimens of his carbide to Lord Kelvin, with a letter—a copy of which I have seen in Willson's letter-book, and which amply proves that he was perfectly aware of the importance of the product. This was acknowledged by Lord Kelvin in a letter dated Oct. 3, 1892. About this time, M. Moissan was conducting his classical researches on chemical actions at high temperatures, using for his experimental work an electrical furnace almost identical with the one patented by

Siemens in 1879; and while experimenting with calcium, he found that the vapours of the metal acted upon the carbon electrodes, forming calcic carbide in small quantities—a fact which he incidentally mentioned in a paper read before the Academie des Sciences on Dec. 12, 1892. This, however, contained no more of the germs of a commercially possible manufacture than had the discovery of calcic carbide by Woehler, or the attempts of Borchers to make calcic carbide in his experimental furnace which had extended from 1885 to 1891, and who had succeeded in making this body though he had no idea of the importance of his investigations, which certainly were not of a practical kind. The history of the manufacture of the carbides was also added to in this year by Mr. L. Maquenne, who showed on Oct 17, 1892, that barium carbide could be made by heating barium carbonate with magnesium in the state of powder and charcoal; while Mr. Travers, on Feb. 6, 1893, published his method of making carbide of calcium by heating a mixture of chloride of calcium with metallic sodium and carbon.

It is quite clear that, up to the end of 1892, it was Willson, and Willson only, who had made calcic carbide on anything like a large scale. Nothing would ever have been heard of this material on a commercial scale had it not been that he, in attempting to get capital invested in his process, came across several men of sound practical knowledge whose business instincts led them to grasp the possibilities of carbide and acetylene; and no sooner had these commercial possibilities been noised abroad, than others began to try and make capital from them. In France, in 1894, Bullier took out a patent for the preparation of the carbides of the alkaline earths based on Moissan's researches. M. Moissan himself has never claimed priority in the manufacture of commercial carbide; and, indeed, while lecturing before the New York Section of the Society of Chemical Industry, on Oct. 26, 1896, he distinctly stated that the credit of the first production of calcic carbide on a commercial scale, and the industrial utilization of acetylene, belonged to the Americans. I must say it seems to me that, when this is shown on Moissan's own evidence, further comment is needless.

Willson continued his experiments on the manufacture of carbide on a commercial scale through 1892 and 1893; and having formed a Company, of which Major Morehead was the President, the manufacture was continued at the works at Spray, in North Carolina, in which a dynamo worked by water power, and generating a current of 2000 ampères at 25 volts was employed. By this time the manufacture of carbide was well launched. The first English plant for its production was erected at Leeds; while later on a large installation driven by water power was erected at Foyers, and has been working ever since. This is the source from which nearly all the self-titled manufacturers of calcic carbide in this country obtain their supplies.

On the Continent large numbers of works have been already erected, while others are in progress; and the rapid demand for carbide which has arisen, owing to the introduction of acetylene for railway carriage lighting and the illumination of small towns, has outstripped the supply. From time to time carbide famines are threatened; while the price of the material fluctuates considerably. Practically the same condition exists in America, though the output amounts to between 10,000 and 12,000 tons per annum. So that, though the manufacturers of generators in this country are fond of grumbling at their orders not being filled as rapidly as they wish, they may console themselves with the fact that they are far better off than people in most parts of the world. Even in Germany, which claims pre-eminence in the various branches of chemical manufacture, they obtain up to the present by far the largest portion of the supply of carbide from Switzerland, where the works at Neuhausen turn the carbide out at a lower price than could be competed with by the Bitterfeld works in Prussian Saxony, which had used steam instead of water power. The latter Company have now, however, removed their plant to Neuhausen, where it will be re-opened with water power for the generators; and they are erecting works capable of turning out a very large yield.

The reports of Mr. Frank H. Mason, the American Consul-General at Frankfort, which constitute perhaps the most valuable contribution to our knowledge of Continental industries, owing to his great practical knowledge and the accuracy of his information, point out that the whole of the carbide industry, so far as Central Europe is concerned, is now in a transition stage, and the conditions of supply and price are likely to be greatly modified by the enormous increase of production which is now being arranged for. Not only have the factories in Germany, Austria, and Switzerland, at work and in course of construction, arranged for the utilization of 35,000-horse power to be devoted to this purpose, but another important accession will come through the operations of a big combination headed by the Schückert Electrical Manufacturing Company, of Nurenberg, who expect to have in operation during the course of next year works in various parts of Europe where water power can be obtained cheaply, to the amount of about 18,000-horse power, capable of producing some 20,000 tons of carbide per annum. There are also ten factories at present at work in France; while four others are in course of construction.

In the manufacture of calcic carbide in the electric furnace, lime and hard metallurgical coke of the highest possible degree of purity are employed; and a good working mixture of these materials may be taken as being 100 parts by weight of lime with 68 parts by weight of carbonaceous material. About 1·8 lbs. of this is used up for each pound of carbide produced. It must not be forgotten, in computing the cost of carbide, that lime of sufficient purity for the purpose is not only costly but difficult to obtain in large quantities. It is found that, as the ingot of calcic carbide is formed in the furnace, though the ingot itself consists of pure crystalline calcic carbide, it is nearly always surrounded by a crust in which the carbide contains a certain proportion of imperfectly converted constituents, which therefore give a lower yield of acetylene than the carbide itself; and in breaking up and sending out the carbide for commercial work, packed in air-tight drums, the worst of the crust is as far as possible picked out and rejected. It is perhaps misleading to state the amount made per electrical horse power, as a certain amount of loss is of necessity entailed during the breaking and packing. For instance, in practical working I have found that, while the furnace return was 0·504 lb. per kilowatt hour, this amount has been brought down to 0·406 lb. per kilowatt hour when the material has been broken up, sorted, and packed in air-tight drums.

It will be sufficient for practical purposes to state that the cost of the material, labour, and wear and tear of plant, independent of the power used in the electric furnace, but inclusive of packing, for making a ton of packed carbide will amount to from £3 to £4, according to locality, which, of course, entirely governs the cost of the material used; while the cost of the electrical horse power necessary for the conversion of the material will entirely depend on whether it is obtained from steam, gas-engines, or water power—the latter, where obtainable, being the cheapest, and in this country costing nearly £4 per electrical horse power per year.

The two principal processes utilized in making calcic carbide by electrical power are the ingot process and the tapping process. In the ingot process the coke and lime are finely ground and carefully mixed in the right proportions to suit the chemical actions involved. The arc is struck in a crucible, and the powered mixture allowed to flow in and partially fill the crucible. An ingot gradually builds up from the bottom of the crucible; the carbon electrode being raised from time to time automatically or by hand, to suit the diminution of resistance due to the shortening of the arc by the rising ingot. The crucible is of metal, and considerably larger than the ingot; the latter being surrounded by a mass of unreduced material which protects the crucible from the intense heat. When the ingot has been made and the crucible is full, the latter is withdrawn and another substituted. The process is not continuous; but a change of crucibles only takes two or three minutes under the best conditions, and only occurs once in every ten to fifteen hours. The essence of this process is that the coke and lime are only heated to the point of combination, and are not "boiled" after being formed.

In the tapping process a fixed crucible is used, lined with carbon. The electrode is nearly as big as the crucible; and a much higher current density is used. Fine grinding is unnecessary, as combination probably only takes place after fusion of the raw materials, which mix more or less as liquids. The carbide is heated to complete liquefaction, and tapped at short intervals. There is no unreduced material; and the process is considerably simplified, while less expensive plant is required. But, on the other hand, the output in carbide per electric horse power per day is considerably less than in the ingot process; and it is only more economical when power is comparatively cheap.

Many attempts have been made to economize the amount of current necessary in making the carbide, by heating a mixture of lime and carbonaceous material before exposing it to the action of the arc; but it has never been clearly demonstrated that anything has been gained by doing this. When the manufacture of calcic carbide was in its infancy, the idea of preheating the constituents, to save in the current, was a favourite one with inventors; and a large number of patents were taken out for electric furnaces working on this principle. But with extended practice, the fallacy of this economy became apparent.

The best carbide is made when a finely powdered and intimate mixture of pure lime and coke of very low ash is presented to the action of the arc for just sufficient time to fuse it and convert it into carbide. If, however, attempts are made to preheat this mixture by exterior heating, some of the carbon is burnt away, and the proportion of carbon to lime altered; while if interior heating be attempted, the rush of hot gases carries away the lighter particles, and destroys the homogeneous nature of the mixture in that way as well as by burning off carbon. If attempts be then made to overcome these evils by using a coarsely ground mixture of the ingredients, a bad carbide is produced, owing to the interaction between the carbon and lime never being properly completed; and in attempting to overcome this last trouble, the material is often kept too long in the arc, thereby lowering the quality of the carbide still further by overheating. M. Nicolai has shown that overheating leads to dissociation of some of the carbide; and the result of this is well indicated by remelting a sample of carbide of known composition, after which it develops about 12 per cent. less gas than before, while a second remelting more than doubles the loss. Another grave disadvantage of overheating also is that metallic calcium is produced, which during the decomposition of the carbide by water gives rise to hydrogen. In one class of furnace, the raw

coke and lime are heated before entering the furnace crucible by being placed in a metal bin subjected to the action of the hot furnace gases, and sometimes heated by a fire from underneath.

Pictet places a mixture of comparatively large pieces of lime and coke, with a considerable excess of the latter, in a refractory crucible which has a hole at the bottom, below which a horizontal arc furnace is situated. A row of tuyeres round the upper part of the crucible supplies a hot blast of air, which consumes some of the coke which has been previously ignited, and thereby heats the descending charge. A second row of tuyeres lower down in the crucible supplies water gas and hot air simultaneously, and heats the mixture to a still higher temperature. The mixture then passes out between the carbon poles; and the carbide is said to be made. Here, again, it is very doubtful whether the economy claimed for this process is borne out in practice, as the gain from the prior heating of the material (if any) is more than counterbalanced by the difficulty of reducing the large lumps; while the expense of the water gas and air blast would be no small item, and the quality of the carbide in all probability would not be of the best.

There is a rotating furnace which is used in one large works in the United States; and there are modifications of this which I believe are being tested by Mr. Willson. A rotating drum of cast iron is fitted round its periphery with a number of removeable iron plates, thus forming an annular space on the outside. The carbon electrodes are placed in a hopper made of refractory material at one side of the drum; the electrodes being parallel to two opposite sides of the hopper; and meeting (with the formation of an arc) just over the annular space in the drum. Only one-half or two-thirds of this annular space is closed at a time; the closed part extending from just below the hopper downwards to the other side. A mixture of powdered coke and lime is fed into the hopper, some falling between the electrodes, which are then drawn apart as carbide is formed, until a block of carbide 4 or 5 inches thick is built up between the electrodes, while an arc plays on both sides of the block between the electrodes. The electrodes are now clamped down; and as the ingot tends to short-circuit the arcs, the drum is rotated a little by worm gearing, thereby drawing a little of the ingot and mixture into the annular space, and introducing more raw material to the arc. This process goes on continuously, until the carbon poles are exhausted. The carbide forms round the drum, and is broken off in pieces on the other side by removing the periphery plates as they come round.

I have had the good fortune to be able to secure photographs of some of the most interesting machinery connected with the carbide manufacture; and you will see that the plant used at nearly all the large factories may be looked upon as developments of Willson's original plant as used at Spray, the photograph of which I think is of exceptional interest.

During the past year the air has been full of reports as to various processes for making carbide without the aid of electricity; and it is said that this has been successfully accomplished. But I confess that until I have the evidence of my own senses to go upon, I shall remain sceptical as to the carbide being produced more economically by such means than by electricity, even if produced at all on a large scale. In 1894 and 1895, I made many experiments in this direction, built up a small experimental plant, and used every method for generating high temperatures that was available; and I succeeded in fusing practically everything save the mixture of lime and carbon. It was an easy matter to run down the lining of the furnace—indeed, to melt the whole furnace itself—but the direct combination of the carbon with the lime was not to be obtained in this way. It then seemed probable that the result might be secured by highly heating lime in the presence of decomposing hydrocarbons, so that the nascent carbon might combine with the lime at the moment of its liberation. But this was tried in many different ways without any very encouraging results, though it is possible, by decomposing such organic compounds as calcic tartrate by heat and raising the temperature of the mass, to get traces produced. The price of the organic compounds, however, under these conditions would be prohibitive.

Another point which always seemed to be against the direct formation of calcic carbide by heat is that the temperature needed for its formation is 2700° C., and if you take calcic carbide and attempt to fuse it at any obtainable temperature short of the electric arc, you fail to do so; while if the oxy-hydrogen blowpipe be used for this purpose, not only do you fail to fuse the carbide, but you decompose that which you already have, and the lump which is left behind consists mainly of carbon, carbonate of lime, and lime. It is possible, however, that by using carbon burning in oxygen a sufficient temperature could be reached to fuse the mixture, or at any rate induce the combination of the mixture of lime and carbon with the formation of carbide; but the temperature which would do this would prove fatal to the furnace itself. There is not the slightest doubt that the next year will see very many experiments with gaseous mixtures rich in oxygen, made at a remarkably cheap rate by methods such as the Linde process for liquefying air and allowing the nitrogen to boil off; and some of these may be successful in overcoming the existing difficulty. It is reported that Dr. Borchers has succeeded in making carbide by some method akin to this; but there are many considerations which lead to the belief that, even if this feat has been accomplished, its practical value will be but little. Given water gas, regenerative settings, and cheap oxygen, an enormously high temperature can be attained; but the material of which to build a crucible or furnace that will stand it, has yet to be discovered.

In using the electric furnace, the intense heat of the electric arc is generated in the centre of the mass to be fused by it, and so the wear and tear to the furnace is avoided. But this would be practically impossible, even if the requisite temperature could be reached, by a combustion process; and the result would be that the electrical heating would probably be less expensive than the other. It is perfectly well known that if a temperature commercially practicable is to be used, some metal with a strong affinity for oxygen must be employed to reduce the lime to calcium before combination with the carbon will take place. But such metals as will do this—potassium, sodium, and magnesium, or even zinc—are costly; and if a process were devised in which the vapours of such metals were liberated by reduction from their salts, and were made to interact with carbon and lime at a high temperature, it could only be made commercially possible either by a large demand being created for the bye-product, or by its being capable of being cheaply worked up and used over again. In either case the probabilities are that the cost would exceed that of making carbide by electricity generated by water power.

Another point of a purely unscientific character is that during the past few months very large amounts of capital have been subscribed for the erection of factories for making carbide by water power on the Continent; and practically little or none can be traced for processes for making carbide without electricity—which shows no great amount of confidence in the many schemes suggested. There is a Company in Liepzig, having works at Cassel, who are supposed to make carbide without electricity, by smelting the constituents by acetylene blow-pipes working under considerable pressure; but it does not appear possible that this could be made to compete economically with the ordinary electrical method.

One of the schemes for the manufacture of carbide is for producing it from blast-furnace slag, which contains a certain amount of lime, together with all the impurities derived from the fuel, ore, and limestone used in the furnace. According to the inventor, this mixture is to be run into Bessemer converters, impregnated with coke powder blown into it through the converter trunnions, and is then poured out between a series of carbon electrodes between which a powerful current is flowing. In twenty minutes this converts the slag into a material named by the inventor "carbolite," and which is supposed on contact with water to yield 5 cubic feet of gas per pound. Such a substance might contain 40 per cent. of carbide of calcium; but the impurities would be so pronounced that it would be practically useless for generating acetylene for indoor lighting.

Carbide of calcium as formed in the electric furnace is a beautiful crystalline semi-metallic looking solid, having a density of 2·22, and showing a fracture which is often shot with irridescent colours. It can be kept unaltered in dry air; but the smallest trace of moisture in the atmosphere leads to the evolution of minute quantities of acetylene, and gives it a distinctive odour. It is infusible at temperatures up to 2000°C., but can be fused in the electric arc. When heated to a temperature of 245°C., in a stream of chlorine gas, it becomes incandescent—forming calcic chloride, and liberating carbon; and it can also be made to burn in oxygen at a dull red heat, leaving behind a residue of calcic carbonate. Under the same conditions, it becomes incandescent in the vapour of sulphur—yielding calcic sulphide and carbon disulphide; while the vapour of phosphorus will also unite with it at a red heat. It is composed of: Calcium, 62·5 per cent.; carbon, 37·5.

Acted upon by water, calcic carbide is at once decomposed, yielding acetylene and calcic hydrate. Pure crystalline calcic carbide yields from 5·5 to 5·8 cubic feet of acetylene per pound at ordinary temperatures; but the carbide as sold commercially is a mixture of the pure crystalline material with the crust which in the electric furnace surrounds the ingot, and which, of course, yields less gas; the two being blended together to yield an average of 5 cubic feet of gas per pound of carbide under proper conditions of generation. But, as we shall see later, the volume of acetylene to be obtained from the carbide depends very largely upon the form of apparatus used; and while some will give the full 5 cubic feet, other apparatus will only yield with the same carbide 3¾ cubic feet.

The purity of the carbide entirely depends upon the purity of the materials used in its manufacture; and before this fact had been fully grasped by the manufacturers of carbide, and only the purest material obtainable employed, the carbide contained notable quantities of compounds which during its decomposition by water yielded a somewhat high proportion of impurities in the acetylene generated from it. And although at the present time a marvellous improvement has taken place all round in the quality of the carbide produced, the acetylene nearly always contains minute traces of hydrogen, ammonia, sulphuretted hydrogen, phosphuretted hydrogen, siliciuretted hydrogen, nitrogen, and oxygen, and sometimes minute traces of carbon monoxide and dioxide.

The formation of hydrogen is caused by small traces of metallic calcium occasionally found free in the carbide; and cases have been known where this was present in such quantities that the evolved gas contained nearly 20 per cent. of hydrogen. This takes place when, in the manufacture of the carbide,

the material is kept too long in contact with the arc, as this overheating causes the dissociation of some of the calcic carbide and the solution of metallic calcium in the remainder. The presence of free hydrogen is nearly always accompanied by siliciuretted hydrogen, which is formed by the combination of the nascent hydrogen with silicon in the carbide. It has usually been stated that this siliciuretted hydrogen has been formed by the decomposition of silicides present in the carbide; but in spite of a long series of experiments which I have made, I have never yet been able to form a metallic silicide which will decompose with water with the evolution of this gas, and the silicides which analyses prove to be present in the carbide are certainly not decomposed in this way.

The ammonia found in the acetylene is due to the presence of magnesium nitride in the carbide; and this is formed by the metallic magnesium in the molten condition in the ingot taking up nitrogen from the air. When this comes to be decomposed by water, ammonia is produced by the action of steam or of nascent hydrogen on the nitride; the quantity formed, however, depending very largely upon the temperature at which the carbide is decomposed. The formation of nitrides by actions of this kind, and their easy conversion into ammonia, will probably at some no very distant date prove to be a useful method of fixing the nitrogen of the atmosphere and rendering it available for manurial purposes, though it could never compete in price with ammonia formed in the distillation of coal for coal gas.

Sulphuretted hydrogen, which is invariably present in commercial acetylene, is formed by the decomposition of aluminium sulphide; and it has been shown by Murlot that aluminium sulphide, zinc sulphide, and cadmium sulphide are the only sulphur compounds which can resist the heat of the electric furnace without decomposition or volatilization. Of these, aluminium sulphide is the only one which is decomposed by water, with the evolution of sulphuretted hydrogen. In the early samples of carbide, this compound used to be present in considerable quantity; but now it has been reduced to so small a limit that one rarely finds more than one-tenth per cent. of sulphuretted hydrogen in the acetylene generated from commercial carbide.

Phosphuretted hydrogen, which is one of the most important impurities, and which has been blamed for the haze formed by the combustion of acetylene under certain conditions, is produced by the action of water upon traces of calcic phosphide found in carbide; and though at first it was no uncommon thing to find a half per cent. of phosphuretted hydrogen present in the acetylene, this has now been so reduced by the use of pure materials that the average quantity is rarely above one-fifteen hundredth of a per cent., and often not one-fifth of that.

I have made many experiments on the effect of the impurities in calcic carbide upon the safety of the material, and have come to the conclusion that such impurities as are now found in the commercial carbide may be looked upon as practically innocuous. With proper care and supervision in the selection of the materials for making the carbide, all trouble on this score may be disregarded, as spontaneous ignition due to the liberation of phosphuretted hydrogen which would be the chief risk dependent on the use of impure material is now practically impossible.

In the earlier days of carbide manufacture, several cases of the spontaneous ignition of the gas occurred; and though the analysis of many different brands of carbide from all countries of the world show that in the carbide itself there is not sufficient impurity to bring about this result, it seemed possible that the concentration of the phosphorus compounds might take place in the outer crust formed around the ingot during manufacture. Experiments were made therefore to see if this were so. By the courtesy of the Acetylene Illuminating Company, a portion of an ingot with its crust intact was obtained; the crystalline material of the ingot containing 96·7 per cent. of true carbide, while the crust, though varying very much in composition according to its distance from the ingot, contained an average of 51·9 per cent. of carbide. A second sample of ingot and crust gave even better results; the ingot containing 99 per cent. of carbide, and the crust 77 per cent. Analyses were made of the acetylene from these samples; but the results showed no indication of the poorer material being richer in phosphorus compounds than the ingot itself.

On breaking up some ingots of calcic carbide, metallic nodules manifestly differing from the pure carbide are observed, and are far more abundant in specimens of foreign manufacture than in English-made carbide. These nodules are generally found in a spherical or oval shape, and have evidently separated from the molten mass on the crystallizing of the true carbide. From this it seemed highly probable that a concentration of the impurities might take place, and that the presence of these nodules might be an active source of danger.

In order to verify this point, calcic carbide was obtained in bulk; and both English and foreign makes were represented. This carbide was then carefully broken up; and the nodules and anything which appeared to differ from true carbide were collected. The nodules differed somewhat in appearance; two distinct varieties being clearly noticeable: (*a*) Grey nodules, not attracted by the magnet, and not oxidized when exposed to the air or heated as a solid lump in the blow-pipe flame. Specific gravity, 3·5 to 5·8. In a fine powder some had a very faint garlic-like odour, gained 5 per cent. when heated for half an hour, and attacked platinum when heated on it for some time. These nodules gave no gas when acted upon by water. (*b*) Steel-like nodules, which were strongly magnetic, and became coated with iron rust when exposed to moisture and air for some time, and which gave no gas when acted on by water. Specific gravity, 6·3 to 6·8.

Analysis showed that the foreign matter present in the carbide consisted of carborundum or silicide of carbon; metallic silicides; iron, occasionally metallic calcium, magnesium, aluminium, and traces of nitrides; phosphorus and sulphur compounds. One of the nodules on analysis yielded—

Silicon	30·76
Iron	58·06
Calcium	2·65
Aluminium	3·01
Magnesium	0·64
Carbon, &c.	4·89
	100·00

None of these substances gave spontaneously inflammable gases when acted upon by water; but in a few instances a nodule was found which evidently contained magnesium silicide, and which, when powdered and acted upon by hydrochloric acid, gave a few bubbles of spontaneously inflammable gas.

M. Gerard, Chief of the Municipal Laboratory at the Prefecture of Police, Paris, has also analyzed some of these nodules, with the following results:—

Iron	55·027	..	53·250
Silicon	33·172	..	31·800
Aluminium	5·579	..	8·910
Calcium	2·764	..	4·120
Not determined and loss	3·458	..	1·920
	100·000	..	100·000

M. Gerard found that these alloys, pulverized and treated with concentrated acid, gave off siliciuretted hydrogen. In some cases, it was discovered that the carbon deposited by holding a cold surface in an acetylene flame contained traces of silica; and this seems to support the idea that siliciuretted hydrogen may occur in the acetylene. But if it does, the amount is so small as certainly to give no danger of spontaneous ignition. A sample of gas which appeared to give a considerable quantity of silica was burnt under such conditions as to allow of the silica being collected; and on estimating the quantity formed, it was found to correspond to 0·01 per cent. of siliciuretted hydrogen in the original gas.

M. Gerard also carried out a number of extremely interesting experiments upon the products found in the residues left after treating the calcic carbide with water; and he succeeded in extracting from them minute diamonds. The residues were, as far as possible, dissolved in hydrochloric acid, and the insoluble portion separated by filtration and washing with water; the metallic portions being separated by sieving. The finer portions were collected on a filter paper, washed, and dried, and were then heated with potash in a silver capsule, and the insoluble portion treated with aqua regia. After repeating this drastic treatment two or three times, the residue was put into a separating funnel containing a saturated solution of the double iodide of mercury and potassium (which has a density of 2·9), in which silicide of carbon will float, while graphite sinks. This silicide of carbon is then purified by being treated several times with concentrated hydrofluoric acid, and after washing is dried; while the graphitic bodies are treated and separated with iodide of methylene, which has a density of 3·29.

The separation of diamondiferous bodies from the silicide of carbon is effected by a saturated solution of cadmium bromotungstate or iodide of barium and mercury. Microscopic slides of these various bye-products were sent by M. Gerard to Mr. Worth, of the Acetylene Illuminating Company, who from the first has kept in touch with all the leading chemists in Europe, and has supplied them with any samples of English carbide that they needed; and it is through the courtesy of Mr. Worth that I am able to show you these fine slides prepared from the bodies extracted by M. Gerard. The labour entailed in the separation of this diamond-containing powder may be estimated when it is stated that it was necessary to treat no less than between 700 and 900 lbs. of carbide in order to obtain ·154 grain of this material. The evidence upon which M. Gerard bases his assumption that these minute crystals are in reality diamonds formed at the intense temperature of the arc, is that when they are burnt in oxygen they yield nearly the theoretical volume of carbon dioxide. M. Moissan has failed to find diamonds in the specimens of carbide he has examined; but this is probably due to the quantities worked with being far smaller than those treated by M. Gerard.

There is no more risk in the storage of calcic carbide than there is in storing any other inert material, provided it is packed dry and warm in hermetically sealed drums, so as to render it impossible for it to come in contact with water or moist air. The real risk is in the removal or redistribution of the material. After opening a drum it may not be again properly closed; and if the drum be left in this condition in the moist air of an ill-ventilated cellar, it is quite possible for a slow generation of gas to take place, and for an explosive mixture to be formed by its accumulation. All carbide stores should be thoroughly well ventilated and above ground; and when this is the case, all danger is practically done away with.

For the carriage of carbide, it is important not only that

the drums should be air-tight, but that they should be of sufficient strength to resist the rough usage incidental to the handling of a heavy product; and where tins are used, they should always be protected by an exterior wood case.

AMERICAN GASLIGHT ASSOCIATION.

The Twenty-Sixth Annual Meeting at Niagara Falls, N.Y.

(*Continued from p.* 1164.)

A paper on "The Loss of Illuminating Power of 25 to 30 Candle Gas when Mixed with Air," was read by Dr. E. G. Love, of New York. The author commenced by referring to a table showing the results of experiments in this direction, as published by Audouin and Berard in 1862, Aitken in 1878, Smith in 1885, and Schilling and Ries in 1891. These results varied so much that they could not be accepted as conclusive; but they showed in a general way that gas of low quality suffered more by admixture with air than a high-candle gas, and that in either case the injurious effect was greater with flat flames than with argand burners. The percentage of loss for each 1 per cent. of air present in the gas was 6 to 7 per cent. with flat flames, and 4 or 4½ per cent. in the case of argands. All these tests were made with coal gas; and the author was not aware that similar examinations had been made of water gas. He produced a table embodying the results of five series of tests made by himself upon water gas of 25½ to 26½ candle power, each series including a number of mixtures ranging from 3 to 40 per cent. of air. The burner used was a No. 7 Bray slit-union; and the loss of illuminating power per cent. of air added remained fairly regular at 2 per cent. up to 10 per cent. of air, but showed a steady rate of increase in somewhat more than mere arithmetical proportion. Starting with 2·03 per cent. for each unit in a mixture containing 3 per cent. of air, it rose by regular increments to 2·38 per cent. in a 12 per cent. mixture, and to 2·67 per cent. in a 24 per cent. mixture. The loss of value for water gas was therefore approximately only about one-half that arrived at by other experimenters for coal gas; but, of course, the tests were made under different circumstances, and were not fairly comparable. With regard to the appearance of the flame, photographs were exhibited which showed that no marked change was observable if the proportion of air present was not more than 5 per cent. The effect of additions of air was to diminish the size and impoverish the appearance of the flame; and this was, of course, the more prominent with larger proportions of air. The author had made a few observations with an argand burner, and found that the loss by admixture of air was very small; but the effects were more noticeable in the appearance of the flame than at the photometer disc. The first effect was a shortening of the flame, followed by the disappearance of the reddish tip, and a decided increase in the intensity of the brighter portion. At about 25 per cent. of air, the height of the flame was reduced fully one-half; the effect being similar to that produced by lengthening the chimney.

Discussion being invited, Mr. Wheeler said that he had made some tests upon a 24-candle half-and-half gas, and had always found that 5 per cent. of air reduced the illuminating value 13 to 14 per cent. Similar results were observed with a 23-candle water gas. The amount of air that could be safely admitted during the process of oxide purification was under 2½ per cent. The usual practice was, perhaps, 1½ per cent., with which some claimed that there was no loss, and others a slight gain, in luminosity. In this connection, the experiments of Professor Lewes, communicated at the 1897 meeting of The Gas Institute, on the quantity of air, nitrogen, and carbonic acid required to render the flame of a 17-candle gas non-luminous when consumed through a bunsen burner, might be referred to. About 2·3 volumes of air or nitrogen, or a little over one-half this proportion of carbonic acid, rendered the flame completely non-luminous. But with a 43-candle gas, the quantities were respectively 7·9 volumes of air, 4·7 volumes of nitrogen, and 3·1 volumes of carbonic acid—showing that rich gas required far less nitrogen than air to bring about loss of luminosity. A 24-candle gas needed 5·4 volumes of air; and there was also a difference between the proportions required for blue, compared with green, non-luminous combustion. Mr. A. C. Humphreys said that in experiments of this kind it was necessary to bear in mind the initial illuminating power, and the kind of burner used. For instance, it was possible to make a burner that would give better results with 40 per cent. of air than without any air at all. A considerable quantity of air could be added to a rich oil gas without depreciating its practical value.

Dr. Love, in reply, said that photography did not give the exact size and appearance of the flame, as the actinic rays were the only ones that affected the photographic plate. The subject could be followed out in many different ways, some of which were more interesting to him personally than the line he had chosen. He had aimed at treating it as a thoroughly practical question that might be of service to the gas fraternity; but, of course, it might be dealt with scientifically, both as to the proper burners for securing the best results from each mixture and as to the composition of the gas used. The results were affected not so much by the candle power as by the carbon constituents that made up that power.

Mr. J. M. Rusby, of Jersey City (N.J.), read a paper on "The Depth of Fire in a Water-Gas Set," giving the results of some special tests made with a standard double superheater Lowe apparatus, of 5 feet internal diameter, and using naphtha and anthracite coal. The first set of tests was made with a fire 7 feet deep, alternate up and down runs of seven minutes each, similar periods for blowing, and cleaning every twelve hours. The power consumed in blasting was 24 indicated horse power; and the pressure, from 7 to 8 inches of water. The average make of gas (corrected) was 8450 cubic feet per run; the consumption of steam in the generator, 32 lbs. per 1000 cubic feet of gas made. The heats were good, and the consumption of coal and oil satisfactory. In the second series of tests, the fire was only 3 feet deep, with runs and blows as before; but the power consumed in blasting was only from 8 to 14 indicated horse power, and the pressure 5 inches. The fire was cleaned once in seven hours. The make of gas per run was about 5500 cubic feet; the consumption of steam, 48 lbs. The net consumption of fuel was 6 per cent. more per 1000 cubic feet of gas made, and the consumption of oil a little more than in the first series. The conditions of the third series of tests were similar to those of the second, except that the length of blow was varied from three to seven minutes. The make of gas per run was still lower; but the shorter blows caused some economy of fuel. The heats, however, were low, and the consumption of oil excessive. A number of holes were made through the sides of the generator, through which perforated iron tubes could be passed so as to get samples of gas from all parts of the fire. Even with the heaviest blast, it was found that free oxygen disappeared entirely at 2 feet above the grate. As the temperature of the fire rose, during the process of blasting, the conversion of carbonic acid to carbonic oxide was almost coincident. With a seven-minute blow, at a point 2 feet above the grate, the percentage of carbonic acid would range from 17 at the beginning to 7 at the end. The conversion was increased by depth of fire, as the percentage of carbonic oxide was continually increasing toward the top of the 7-foot fire. But owing to the comparatively low temperatures at the upper part, this increase was small; the conversion chiefly taking place in the hot belt found at 2 to 3 feet above the grate The percentage of carbonic oxide was considerably increased by partially closing the blast-valve so as to reduce the supply of air. With a three-minute blow, the proportion of carbonic acid could be kept within 11 to 16 per cent.; and it was always 2 or 3 per cent. less after a down run than after an up run, because the fire was hottest after a down run. A few analyses of water gas were also made. The percentage of carbonic acid in the uncarburetted gas would increase at the rate of 2 or 2½ per cent. during the progress of a run; but it was reduced by shortening the run and decreasing the steam supply. In making plain gas, the object was to keep as much of the heat in the generator as possible; but when carburetted gas was desired, the superheaters also required to be heated up. This had to be done by the combustion of carbonic oxide from the generator; and it needed a sufficient period of time. A great increase in production of gas, both per minute and per run, was obtained when the depth of the fire was increased to 7 feet. As much air was supplied to the shallow as to the deep bed, and the combustion was complete in each case. The larger production was therefore due to the absorption of heat from the blast gas in the upper part of the fire. But this did not mean increased economy of fuel, because the percentage of carbonic oxide was also increased, and there was a loss of carbon. The upper part of the fire, however, stored heat during the blast, and gave it out during the run, increasing the quantity and also the temperature of the product, and thus making the work of the carburetter and superheater more regular and easy of control. A shallow fire offered the advantage of a saving of power in blasting, and the reduction in size and speed of the blowers; but against this a larger or a specially designed generator was required to give the same productive capacity as a deep fire. The consumption of steam, and the difficulty of properly heating the fixing vessels, would also be increased. The coarseness or fineness of the fuel used largely affected the depth of the fuel-bed; and with the kind of fuel at his disposal, he believed a depth of 5 to 6 feet, with short blows, would give the best all-round results.

Mr. Norris, in opening the discussion, said it was evident that the heat retained in the fuel-bed after blowing up was the difference between the calorific value of carbon and the heat carried off, as sensible heat or as potential heat, by the products of combustion. Anything that tended to reduce the heat carried off, would therefore tend to economize fuel. A shallow bed of fuel would give less potential heat carried off because the percentage of carbonic oxide in the escaping products would be less, but more sensible heat as the products did not have so much opportunity of giving up their heat to the upper part of the bed of fuel. The effect of reducing the depth of the fuel-bed was a gain in one way and a loss in another; and it did not appear from the figures quoted that the net consumption of fuel per 1000 cubic feet of gas made was very largely affected by the depth of the fuel-bed. But in other ways there was a marked advantage with the deeper fire. The author's analyses also showed that the percentage of carbonic acid in the products was affected more by the temperature than by the depth of the fuel. Commencing with 18 per cent. of carbonic acid at the beginning of the blow, there was less than 10 per cent. at the end, and, of course, a proportionate increase of carbonic oxide.

A common idea was that fuel would be saved by cutting off the last minute of the blow; but this was a mistake, as reducing the length of the blow would also reduce the length of the run. He proceeded to quote a number of analyses of products of combustion, made with a 4-inch blast pressure, and with gas coke as fuel, in a 6-foot generator. In each case the percentage of carbonic acid gradually decreased, being only about half the quantity by the end of the seventh minute, as at the end of the second. The carbonic oxide showed a corresponding increase; reaching 18 or 20 per cent. at the end of the seventh minute. The proportion of carbonic acid had been shown to be to some extent independent of the depth of fuel. The deeper the fuel, the stronger the blast, and therefore the larger the quantity of steam admitted. The decomposition of steam tended to increase the bulk of the gas, and therefore apparently to reduce the percentage of carbonic acid, though the actual quantity might remain the same. Mr. Miller had made some experiments to check the author's results; and they showed a marked agreement. He had also determined that the more economical plan was to run the fire at a low temperature. Mr. Egner remarked that Dellwik obtained the advantages of both the shallow and the deep fire, by admitting air into the generator at various levels above the grate. He was thus able to make short blasts and save fuel, at the same time getting sufficient heat to decompose all the steam. Dellwik's idea seemed to be that in the ordinary form of apparatus there was a waste of heat by the production of an unnecessarily large proportion of carbonic oxide; and he aimed at obtaining more carbonic acid in the products of combustion. Mr. Searle had given close attention to the operating of a water-gas set; and he found the best results were obtained with a 3 or 4 foot fire, and a high-pressure blast. In working with anthracite coal, after a time the lumps became coated with ash, and the strong blast penetrated this coating more efficiently than a weak one. A separate generator might work with less fuel; but it required ten times the attention necessary for a double superheater set, and was neither efficient nor economical. He gave anthracite a ten to twelve minutes' blast, but could work gas coke with two-minute blasts and five-minute runs. He regulated the depth of fuel and length of blow according to the quality of the fuel. Mr. Francis Carroll had found that as good a quality and yield of gas could be obtained from a 3-foot bed of fuel as from a 6 foot one; but there was too much danger in working the low fuel bed. Mr. Forstall said that the separate generator appeared simpler and easier in working than the combined set; and he hoped someone would find out how to work it as cheaply. He was rather hopeful about the Dellwik process, as there was less danger of loss of sensible heat than of loss of carbonic oxide. He had worked both the separate and the combined systems; and his experience differed from that of Mr. Searle.

Mr. Rusby, in reply, observed that Dellwik had shortened the blast considerably; and in his opinion this accounted for the improved results. Gas coke was more porous, and therefore a worse conductor of heat, than anthracite; consequently it heated up more rapidly under the blast. With a high temperature in the generator, the formation of carbonic oxide was immediate; and if a coke fire got very hot on the surface, there would be a large production of carbonic oxide. In this case, the only thing possible was to reduce the thickness of the fuel-bed.

(To be continued.)

Gas Workers' Pay and Holidays at Blackburn.—The Secretary of the Gas Workers' Union has made application to the Blackburn Corporation Gas Committee for an increase of the wages of the labourers, and a week's holiday with pay for all the men employed at the gas-works. Last Thursday, the Town Council confirmed a resolution of the Committee that the matter should be deferred until the next meeting, and that in the meantime the Gas Engineer should prepare a tabulated statement showing their position in the matter.

Street Lighting by the Incandescent Gas System.—Now that the question of the adoption of the Welsbach system for street-lamps is being discussed more or less by lighting authorities in various parts of the kingdom, it is interesting to note that in Liverpool, where the Corporation are the owners of the electric light undertaking but not of the gas-works, they nevertheless employ the above-named system for illuminating the thoroughfares of the city, while recommending the use of the electric light to the public generally. The fact affords evidence of the satisfaction of this important Local Authority with the incandescent gas system on the score of economy and efficiency.

Letting Gas-Stoves on Hire at Southport.—On Monday last week, Mr. E. P. Burd, one of the Inspectors of the Local Government Board, held an inquiry at Southport respecting an application by the Corporation for a Provisional Order authorizing them to borrow an additional sum of £5000 on the gas-stove account, and for the purpose to amend the Order of 1895, by altering the amount to be borrowed from £10,000 to £15,000. Among those present were Dr. Williams (Town Clerk), Mr. G. Lloyd (Borough Accountant), and Mr. J. Booth (Gas Engineer). The Town Clerk said the Corporation had borrowed the sum of £10,000, and had already expended about £8600. They estimated that the whole of the amount would be spent by about May next, and that the additional £5000 for which they asked would carry them on for about two years. The Borough Accountant and the Gas Engineer gave evidence in support of the application, showing by statistics the great increase there had been in the sale and hire of gas-stoves in the borough. It was stated that the profit on the gas sold for cooking purposes came to 1½d. per 1000 cubic feet. The net profit on the gas supplied for cooking and lighting last year was £6800. The inquiry only lasted a few minutes.

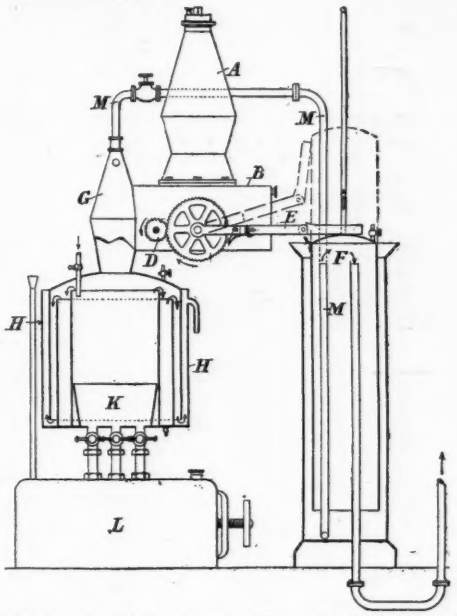
REGISTER OF PATENTS.

Burners for Incandescent Gas Lighting.—Wilson, J., of Birmingham. No. 24,328; Oct. 21, 1897.

The patentee proposes to use, in the manufacture of an atmospheric burner for incandescent gas lighting, a "Bray's regulator burner," for the purpose of governing the amount of gas passed into a conical mixing-chamber, the lower part of which is in the form of a flat plate.

Production of Acetylene.—Ravel, L. de, of Marseilles. No. 25,002; Oct. 28, 1897.

The patentee claims as his invention "an automatic and unexplodable apparatus for the production of acetylene gas, characterized by the combination of a hopper and of an oscillating receiver with a distributor-transporter, with endless band always worked in the same direction, automatically by the descent of the bell of the gasometer, through a lever with pawl and toothed gearing."

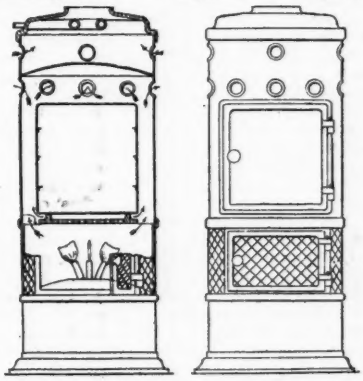


The distributor comprises a hopper A (hermetically closed at top), disposed upon an automatic "distributor-transporter" shut in a box B. In the box B, and beneath the hopper, a receiver oscillates on a transverse shaft; and underneath is arranged an endless band carried by two rollers provided with a pinion D, gearing into a toothed wheel, which causes it to rotate in the direction shown by the arrow, and so bring the carburet from the receiver to the gasogene. The travel of the transporter and the oscillations of the receiver are effected by a lever E, which is raised by the gasholder bell F through a projection, and lowered with it by reason of its own weight when the bell is lowered and no longer supports it. From the band the carburet falls into the gasogene, which is surmounted by the hopper G, having free communication with the box B. The bottom of the hopper is in communication with a fixed bell integral with an exterior vessel H with a waste-pipe. Arranged concentrically within the vessel H are two other vessels, one higher than the other. Finally, in the middle of the central vessel is disposed a tank K, for receiving the carburet falling from the transporter. This tank is in communication with a lime-tank L. At the upper part of the fixed bell, and above the central vessel, is a tube fitted with a cock, for the inlet of water, which it directly pours into the vessel at the time of the charging.

At the top of the part G is a conduit M, with cock, for the passage of the gas from the gasogene to the gasholder already described.

Gas Heating Apparatus.—Richmond, E. W. T., of Warrington. No. 25,252; Nov. 1, 1897.

This is a combined stove and oven, with illuminating gas-burners affording the heating medium. It depends for its equal distribution of

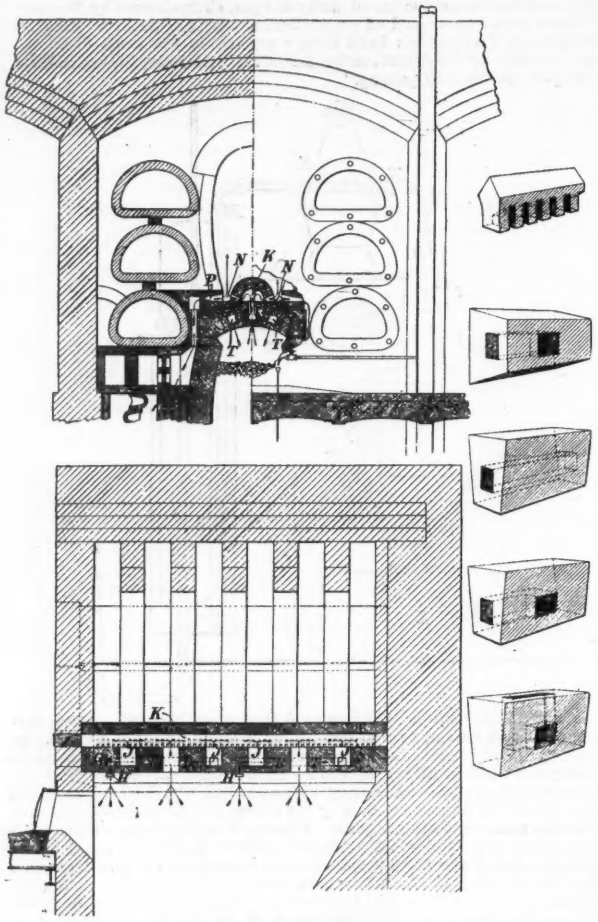


heat upon deflectors, which (as shown) are placed—one over the burners and under the oven, and another above the oven. The heat is by the

latter further utilized for heating the apparatus; while the deflector or distributor under the oven (which is of cast iron) causes the heat which has not been radiated into the room to act upon, and be utilized by traversing, the whole of the exterior of the oven portion.

Regenerative Furnaces for Gas-Retorts.—Helps, G., of Nuneaton. No. 25,265; Nov. 1, 1897.

The principal features claimed for this invention are: (1) The mixing of the gases generated from the fuel, and the dividing up and distributing of them before they are allowed to come into contact with the secondary air. (2) The forming of a number of burners in one arch or oven, whereby several tiers of retorts can be heated from one generator independently of each other.



The illustration represents in part a front elevation and part a transverse sectional elevation of a retort-setting, and part of a regenerative furnace for heating it built with tubular bricks or conduits, and mixing and distributing chamber, and having burners composed of several jets, in accordance with this invention; and a horizontal section of the bench.

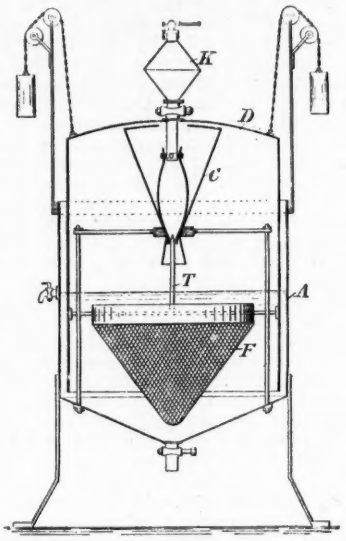
The gases evolved in the generator enter the arch G through the exit passages or ports H leading to the conduits T, through which they are conducted to the uptakes J, and thus into the distributing chamber K. In this manner the gases, entering the exit in the generator side of the arch, near to the front wall, are caused to travel to the back wall or to the middle of the setting, before being allowed to enter the distributing chamber. In the same way, generator gases entering an exit on the generator side of the arch near to the back wall may be caused to travel to the front wall before being allowed to enter the distributing chamber, if desired; and the gases evolved from the generator midway or between the front and back walls of the setting may be caused to pass directly into the distributing chamber, or conveyed to the back or front or to any desired position in the distributing chamber—being conducted to the uptakes J by tubes or passages in the arch over the generator. The tubes or conduits in the arch G can be increased to any number that the thickness and circumference of the arch will allow.

The distributing chamber K extends from the front to the back of the setting, or the generator and all the conduits T are connected with it by uptakes J; and so the gases become thoroughly mixed. Before being allowed to pass into the combustion chamber or setting, they are caused to travel through openings on either side of the distributing chamber, of small area tapering from about 3 square inches on the combustion chamber side to about 1 square inch on the distributing chamber side; and in this manner "the gases are broken up and distributed evenly throughout the whole length of the retort-setting." These openings are similar to those described in patent No. 17,530 of 1896. The gases from the mixing chamber may be distributed throughout the setting to form, in conjunction with the secondary air-inlets P, any number of burners that may be required for the heating of several tiers of retorts. The generated gases issuing from passages N on either side of the distributing chamber, meet the secondary air issuing from a parallel line of similar passages P; and thus two distinct burners are formed, one on each side of the distributing chamber, and each composed of a number of small jets.

The details at the side of the main illustration show: (1) A perspective view of a distributing brick, through whose orifices the generated gases issue from the distributing chamber—similarly constructed to those described for the breaking up of the primary and secondary air in patent No. 17,530 of 1896. (2) A perspective view of a tubular junction arch-brick, for communicating between the generator and the tubular conduit T. (3) A perspective view of a plain tubular arch-brick. (4) A perspective view of a tubular junction arch-brick, for communicating between the tubular conduits T and the uptakes J. (5) A perspective view of an uptake junction arch-brick.

Acetylene Generator.—Kremer, J., of Gilly, Belgium. No. 26,776; Nov. 16, 1897.

It is claimed that this invention will permit of the maintenance of a constant pressure in the generator by "a peculiar arrangement of stopper which, in combination with the gasholder, allows the latter to stop the fall of the carbide into the liquid at the proper moment, without, however, it being limited in its upward movement, which can consequently be continued in proportion to the quantity of gas produced after the stoppage of the hopper."



In the outer receptacle A, containing the liquid for decomposing the carbide, is fixed the hopper C containing the carbide; and in it moves the gasholder D, carrying a vessel K, which allows, even while the apparatus is at work, of renewing the supply of carbide to the hopper by simply operating the cock between it and the holder. The end of the tube conducting the carbide into the hopper is provided with springs forming clips which, moving with the holder, have for their object to push the carbide towards the lower aperture of the hopper and facilitate its fall through same. The holder D is provided with a cross-bar supporting a sieve F, into which the carbide falls. The closing of the exit aperture in C is effected by a cylindrical rod T, pointed at its end. The upward movement of the holder is thus not arrested until it arrives at the top of its course. When a sufficient quantity of carbide has fallen into the liquid, the holder rises, and the rod entering the aperture in C stops any further fall. The production of gas continuing, the holder can still rise; but when, through the consumption of gas, the pressure diminishes, the holder again descends, keeping the pressure constant up to a limit determined by the length of the rod T, which at this moment again uncovers the exit aperture from C, and allows a fresh quantity of carbide to fall into the liquid.

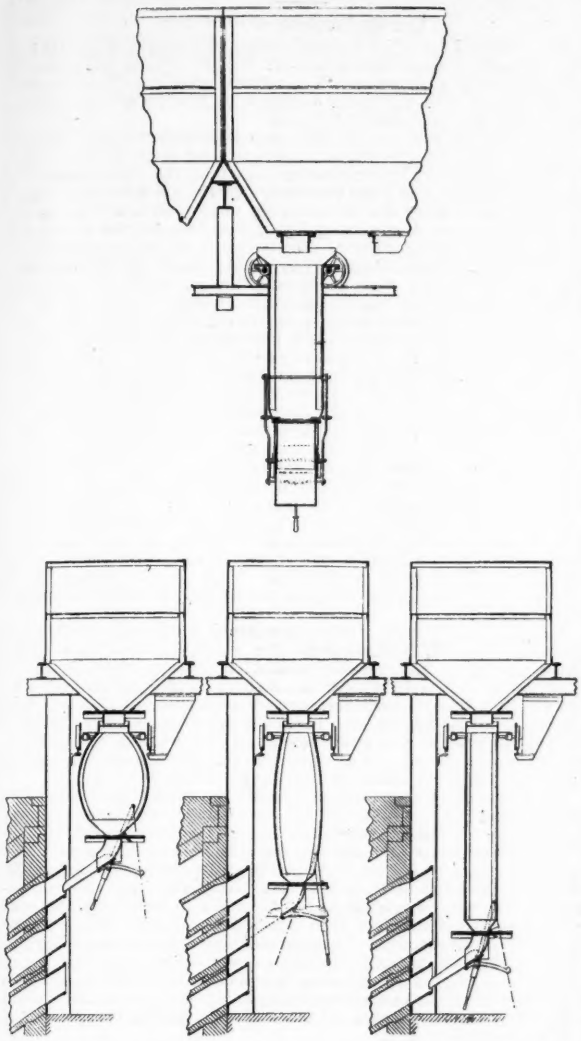
Increasing the Illuminating Power of Coal Gas.—Wigham, J. R., of Dublin. No. 28,526; Dec. 3, 1897.

This invention (the specification of which is not illustrated) is "intended to enable consumers of ordinary gas to use acetylene gas made from calcium carbide for the purpose of increasing the illuminating power of such gas, either throughout the entire premises so lighted, or in such parts of them as it may be desired to have lights of increased illuminating power." It consists in a method of applying acetylene gas to gas made from coal or other material, in order to increase its illuminating power, by means of a governor and other appliances of well-known construction, so as to allow of the exact adjustment of the two gases in any desired proportion. The patentee claims as one "advantage" of his plan that "it would enable gas companies to supply at a cheap rate gas of low illuminating power suitable for cooking and heating, relying upon the combination above described for providing gas of high illuminating power for lighting purposes."

Inclined Gas-Retorts.—Drake, J. A., and Marsland, J. S., of Halifax. No. 29,096; Dec. 9, 1897.

This invention consists in so constructing the apparatus for charging inclined gas-retorts that the fall of coal into the shoots is the same whether it be supplied to the uppermost or the lowermost retort. This is effected by dispensing with the measuring hoppers hitherto employed, and using instead measuring hoppers of different lengths, to suit the positions of the various retorts. Each of the hoppers is of the same capacity, but of a different diameter or size. In order to liberate the coal contained in the hopper, a sliding door or damper is removed from the bottom; but this damper is arranged to be in close proximity to the shoot, so that "the rush of coal which has hitherto choked up the inclined retort is avoided, and perfect work is insured." The invention, so far as it relates to the shoot, consists in mounting it upon a pivot or

fulcrum, so that when it is not in use it may be put back. In doing this, it closes (self-actingly) the damper at bottom of the measuring hopper; but when it returns into action, it does not open the hopper, but slides back alone—the damper in this case being opened by the workman.

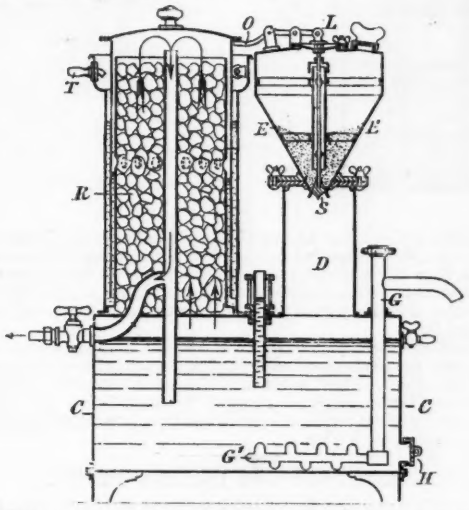


The illustration shows a front elevation of the arrangement and side elevation (to a smaller scale) of the three sorts of hoppers required to charge a bench of retorts three tiers high. It will be seen that they are of different shapes, but all of the same capacity for containing a like amount of coal. They are supplied with fuel from the coal-carrying hoppers above; and their bottoms are provided with sliding dampers. When the retorts require charging, the workman takes hold of the handle of the damper, and pushes it forward, thereby placing the open space of the damper opposite the bottom of the measuring hopper, and allowing the coal to run down the shoot for supplying the retort. When required to feed again, the workman may draw the damper back by the handle, so as to close up the bottom of the measuring hopper to obtain a fresh supply of coal; but the damper may also be shut by a moving handle, as shown in the centre of the three side views, where the lever arm engages with a bowl or stud fixed on a stud underneath the shoot—the shoot being drawn thereby out of position and placed at rest. The action of the handle not only removes the shoot out of position, but at the same time moves the damper so as to place the dead part opposite the bottom of the measuring hopper. The reverse movement of the handle, however, while placing the shoot into position with regard to the retorts, does not slide the damper, but leaves it alone—the damper being slid back into its open position by the workman when required. As the measuring hoppers are all of the same capacity, it will be understood (the patentees remark) that, whether the uppermost or the lowermost retort be fed, the descent of the coal in each case only drops from the dampers which are equi-distant from the retorts; and therefore the rush of coal is the same to one retort or to the other. The arrangement also permits the coal to be lifted from the ground into the coal-carrying hoppers the same height. Therefore the raising of the coal, whether for the top retort or the bottom retort, is the same.

Producing Acetylene.—Lake, H. H.; a communication from J. Grand, of Lyons, France. No. 8382; April 7, 1898.

The patentee remarks that in the greater number of acetylene generators, the carbide container, or distributing funnel, is arranged directly within, and at the centre of, the apparatus—an arrangement which presents numerous disadvantages. It appeared to him therefore to be more practical (while constructing the apparatus with one body only, which serves as its base) to arrange upon this body two distinct parts—the gas-holder bell and the carbide container, or distributing funnel, upon which the bell acts. By this means, the carbide reservoir is not only not subjected to the action of the water vapours in the body of the apparatus, but it is independent, and is thus capable of being rapidly removed in case of need.

The apparatus consists (as shown) of a double circular casing, constituting a water-seal arrangement, within which a gasholder bell works, the weight of which determines the pressure of the gas. The casing is rigidly fixed on a water reservoir C, of sufficient capacity to prevent heating. Upon the side of the reservoir is arranged the gas-supply cock, in communication with a central vertical tube J drawing gas from the upper part of the apparatus, after it has been purified by passing through any suitable purifying medium R (such as coke, iron filings, and so forth) arranged within the casing.

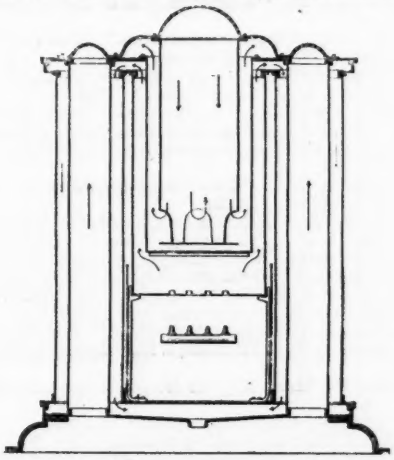


At the side of the casing is fixed (likewise upon the reservoir C, and therefore above the decomposition water) the support D, at the upper part of which is mounted the carbide distributor E. Within the distributor is provided a vertical guide tube, in which slides the rod of a loaded valve S, closing the aperture for the escape of the carbide from the distributor. The upper extremity of the rod is provided with a fork L for the purpose of connecting it with an operating lever O, so as to raise the valve when the holder dome bears against the extremity of the lever.

The apparatus is also provided with an exhaust-pipe G, enabling the decomposition water to escape; a stirring board G^1 for use when the decomposition water is too thick to pass off readily; a cleaning-out door H; and a water-supply nozzle T.

Condensing Gas-Stoves.—Fletcher, T., and Neil, J., of Warrington No. 16,675; Aug. 2, 1898.

In this condensing gas-stove a flat-flame instead of an argand burner may be used, or the atmospheric burner may be arranged to give a circular or bunched flame. Above the flame in the upcast-tube is a throttle-plate, having an oblong opening through it, which practically corresponds in form with the shape of the maximum cross section of the flame, and is arranged with its axis in the plane of the flame. This opening is sufficiently large to allow the products of combustion to pass through it freely; while it limits the induced current of air to such a

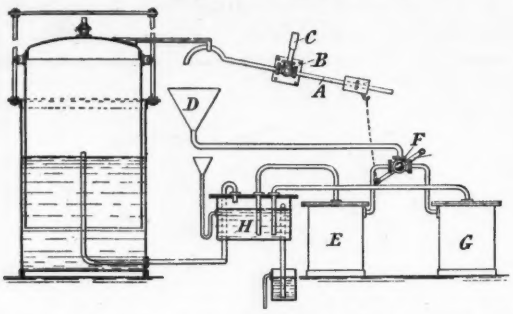


quantity as "will not interfere with perfect condensation." The gases and vapours are thus "caused to pass into the condensing-tubes without admixture with any surplus quantity of air; and the heat carried by them is more easily yielded up, and the vapours therein are more perfectly condensed." Above the throttle-plate there may be arranged a tubular casing closed at the bottom and open at the top. The products of combustion ascend between this casing and a surrounding casing or wall, and pass downwards through one or more condensing-tubes. Each condensing-tube is provided with an internal concentric tube, open at top and bottom, so that air may pass freely.

Within the tubular plate arranged above the throttle-plate, there is a second tubular casing, which is also open at top and closed at bottom. This casing is formed with perforations at a convenient point in its lower end, so that air may descend within the casing, and ascend in a heated condition through the annular space between the two casings—this annular space being also open to the atmosphere at the top.

Acetylene Generators.—Manger, T., of Bamberg, Bavaria. No. 17,449; Aug. 13, 1898.

This invention has for its object to automatically supply the acetylene generator with water, "so that the plant requires very little or no attention, except such as is necessary to recharge the carbide vessels."



As shown, a pipe A has at one of its ends a weight which causes it to press firmly against a lever or arm fixed on a gasholder, and also to close the cock B to the water-pipe C when the holder is by pressure of gas moved upwards. When it falls through diminished pressure of gas, the lever presses down the pipe A and opens the cock, so that water flows into the funnel D.

When all the carbide enclosed in the vessel E is consumed, and the holder sinks, the chain attached to the lever A turns the cock F by means of the lever shown, so that water flows from the funnel D to the second carbide vessel G and the development of gas is continued in the latter.

From the vessels E and G the gas is conducted to cleaning apparatus, and from this to the holder.

APPLICATIONS FOR LETTERS PATENT.

24,002.—Troubetzkoy, L., "Acetylene gas apparatus." Nov. 14.
24,007.—Jacquinet, L., "Incandescent burners." Nov. 14.
24,040.—Léry, J. B. de, "Mantles for incandescent gas and oil lamps." Nov. 15.
24,065.—Margulies, P., "Acetylene gas generators." Nov. 15.
24,093.—Williams, D. S., "Acetylene gas generator." Nov. 15.
24,100.—Rhodes, A., "Glasses for gas and other lamps." Nov. 15.
24,103.—Henze, G., and Barg, B., "A new or improved inverted incandescent burner." Nov. 15.
24,141.—Collingbourne, T. H., "Acetylene gas-lamps." Nov. 16.
24,157.—Richardson, S. T., and Price, R., "Preserving carbide of calcium." Nov. 16.
24,180.—Tourtel, J., and The Tourtel Gas and General Engineering Company, Ltd., "Coin-freed prepayment meters." Nov. 16.
24,224.—Boughton, W. J., jun., "Gas and oil engines." Nov. 17.
24,239.—Ginder, W. J., "Generation of acetylene gas." Nov. 17.
24,283.—Juhasz, F., "Automatic gas igniter for incandescent mantles." Nov. 17.
24,293.—Goodson, J., "Gas-governors." Nov. 17.
24,364.—Nordmann, R., "Incandescent mantles." Nov. 18.
24,408.—Ormandy, W. R., "Gas-producers." Nov. 18.
24,409.—Beech, W. W., and Jones, H., "Generating and storing acetylene and other gases." Nov. 18.
24,458.—Worsnop, C. H., "Acetylene gas-lamps." Nov. 19.
24,493.—Exley, J. H., "Generation and storing of acetylene gas." Nov. 21.
24,501.—Ellen, W., "Acetylene generators." Nov. 21.
24,504.—Simpson, W. M., "Gas-stoves." Nov. 21.
24,541.—Strickland, F., "Internal combustion engines." Nov. 21.
24,580.—Melling, H. T., "Gas-engines." Nov. 22.
24,597.—Sanderson, A. W., "Acetylene generators." Nov. 22.
24,609.—Allyne, E. E., and Anderson, R. G., "Gas-engines." Nov. 22.
24,623.—Newman, F. W., and Critchley, A. H., "Production of acetylene gas." Nov. 22.
24,653.—Semadeni, H. G., "Incandescent gas-mantles." A communication from U. C. Loewy. Nov. 22.
24,679.—Higgins, F., "Chimneys for gas and other lamps." Nov. 22.
24,682.—Falbe, O., "Acetylene gas-generators." Nov. 22.
24,704.—Spittlehouse, R. W., "Acetylene gas-generator." Nov. 23.
24,770.—Myers, T., "Gaseous power engines." Nov. 23.
24,771.—Lanchester, F. W., "Gas-generators." Nov. 23.
24,772.—Salisbury, H., "Carbide holders." Nov. 23.
24,775.—Myers, T., "Gas and other engines." Nov. 23.
24,785.—Bailey, C. J., and Nicklin, J. H., "Generating acetylene gas." Nov. 24.
24,819.—Dye, F., "Leak stoppers for gas, steam, and other tubing." Nov. 24.
24,828.—Myers, T., "Explosion engines." Nov. 24.
24,846.—Irwin, W., "Carburetting or enriching gas." Nov. 24.
24,862.—Dickson, A., and Wallace, R., "Generation and storage of acetylene gas." Nov. 25.
24,891.—Young, W., and Fyfe, J., "Retorts for the destructive distillation of shale." Nov. 25.
24,908.—Lewis, J., "Gas-brackets." Nov. 25.
24,909.—Walker, H., "Making calcium carbide." Nov. 25.
24,910.—Burrell, B. A., "Reverberatory gas-furnaces." Nov. 25.
24,953.—Morris, L., "Generators and lamps for acetylene gas." Nov. 25.
24,954.—Smith, W. B., "Incandescent gas lighting." Nov. 25.
24,956.—Smith, R. H., "Anti-vibrator for incandescent lamps." Nov. 26.
24,975.—Levetus, E. L., "Acetylene generators." Nov. 26.
24,988.—Shelley, R. M., "Incandescent mantles." Nov. 26.
25,006.—Lafond, J. B., "Internal combustion engines." Nov. 26.
25,014.—Moris, L., "Automatic lighting of gas-mantles." Nov. 26.
25,016.—Schwass, A., "Acetylene generators." Nov. 26.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Carburation of Coal Gas.

Sir,—When I wrote you last week giving what appeared to me to be a rational explanation of the action of Mr. Botley's process, I did not expect that the theory advanced would go without criticism. I am, however, much pleased with the spirit displayed in Mr. Botley's letter which appeared in your issue for the 29th ult.

Though I have not seen Mr. Botley's process in operation, I have seen one substantially identical with it, but upon a much larger scale, applied to the abstraction of hydrocarbon vapours from the gases produced in shale distillation; and I was quite aware that it did not require a large volume of gas to spray or atomize the oil. But small as it is, Mr. Botley is, I think, in error in supposing that it does not play the part in his process which I attributed to it. The system to which I have referred is described in the specification of Mr. Beilby's patent No. 2585 of 1882, wherein it is stated: "My improved processes, which are to be used instead of the ordinary washing or scrubbing operations, are effected by injecting, in an improved manner, into the gas to be treated the solvent liquid or substance in the form of a very fine spray, so that the gas and the solvent may be brought into very intimate contact." The specification goes on to describe an arrangement consisting of an engine to compress a portion of the gas to be treated, a coil of pipes to cool the compressed gas, a reservoir for the compressed gas, and various forms of injectors or devices for spraying the solvent into the bulk of the gas in the tower or scrubber. The patentee then says: "My improved processes and apparatus may be applied with advantage to such operations as follow: The separation of soluble hydrocarbons from gases, and the separation of the impurities of coal and other gases. In many cases, the efficiency of the apparatus is much increased by cooling the compressed gas (as hereinbefore described), as in its subsequent expansion when acting on the solvent liquid a further cooling action takes place, which renders the liquid a better absorbent of the soluble matters in the gases. In some cases, however, the cooling may be omitted when not of advantage."

Now, as stated in my last letter, though modified in design, Mr. Botley's process is substantially identical with the system described in this specification; the main difference being that a less quantity of the solvent oil is used, because it is desirable to remove only a small portion, instead of the whole, of the hydrocarbon vapour from the gas, and that part with the lowest vapour tension—the naphthalene. Consequently, it is necessary to compress only a small percentage of the gas to be treated, to spray the smaller quantity of solvent oil; but though small in volume, and proportionately small in degree, it is yet identical in its action.

Mr. Botley says that the temperature of the compressed gas when used at the atomizer is precisely the same as the gas in the carburetter and the town mains. While this may be quite true, it is equally true that the compressed gas on leaving the compressing cylinder will have a very high temperature—many degrees above that of the gas in the main from which it was drawn—due to the mechanical energy expended in compressing it, appearing as sensible heat. According to Mr. Botley, this compressed gas must therefore have parted with this heat before getting the length of the atomizer. Now the compressed gas, in expanding and atomizing the oil, would be suddenly cooled through exactly the same number of degrees as it was previously heated at the time of its compression; and this sudden reduction of temperature would have the effects I attributed to it in my letter, and that stated to result in the specification of the patent referred to.

The statement that the portion of atomized oil precipitated out of the gas and collected in the carburetter itself, and in the syphons of the town mains within the area of the works, does not hold naphthalene in solution, I believe to be equally in error. Petroleum lamp oils, such as those used in Mr. Botley's process, have so powerful a solvent affinity for the hydrocarbon vapours diffused through coal gas, that by bubbling the gas through such oils, or passing it through sawdust moistened with such oils, the illuminating power will be reduced by about one-half; and the supposition that such oil, when presented to the gas in an atomized state, loses its solvent affinity and ceases to be a washing and scrubbing agent, and fails to absorb from the gases the hydrocarbon vapours (including the naphthalene), is what I am afraid Mr. Botley will have some difficulty in getting those engaged in the gas industry to credit. Still less will he be able to convince them that the same conditions which, when applied to the treatment of shale and coal gases enable the vapour tension of the hydrocarbons diffused through them to be so far reduced as to cause them to assume the liquid form and be held in solution in the scrubbing fluid, will have, when applied to the coal gas at Hastings, the very opposite effect—that of creating an artificial vapour tension which not only keeps the vapours in diffusion in the gas, but causes the previously precipitated naphthalene to be again taken up in diffusion, and be carried right up to the burners. I have no doubt but that the scrubbing liquid absorbs or dissolves the previously precipitated naphthalene, and carries it away—but to the drip-well, not right up to the burners.

That the oil used does act as a scrubbing fluid, is further evidenced by Mr. Botley's statement that the portion precipitated and collecting in the drip-wells becomes so saturated with substances taken up in solution, and is precipitated in such quantities, as to make it desirable to transfer it to be worked up in the water-gas plant. The quantity of oil deposited in the fittings of the consumer may be very small; but that it will collect there is no doubt, as, once deposited, it will not, owing to its low vapour tension, be volatilized.

That the illuminating power of the gas is not deteriorated, but, on the contrary, that at the extremes of the districts supplied is better maintained than formerly (which I have never questioned), is no evidence against the theory of Mr. Botley's system being a scrubbing process carried out in the mains and services. It only proves that the part of the scrubbing fluid which is driven into the gas, in a sufficiently fine state of mechanical division to accompany the gas through the burners and add to its luminosity, is greater than the illuminating value of the hydrocarbons (naphthalene, &c.) which have been removed or dissolved from the gas by the less perfectly atomized portion of the scrubbing fluid precipitated in the mains and services. If all the scrubbing fluid was in a sufficiently fine

state of division to pass with the gas through the burners, the illuminating power of the gas would be still better maintained at the extremes of the district. But the very nature of the process makes this desirable result unattainable; for, however finely atomized the oil may be, it is still present suspended as a cloud or mist, and liable to be precipitated by gravitation unless the gas is in rapid motion. On the other hand, the rapid motion causes the particles to be rubbed or impacted out of the gas on its coming into contact with the surface of the mains, services, fittings, &c.

Priorsford, Peebles, Dec. 2, 1898. WM. YOUNG.

Prepayment Meters.

SIR,—I have been reading Mr. Richmond's articles upon "Slot Cookers." I am not desirous of rushing on every occasion into print; but at the same time I feel that in this question I have no right to be left in the cold.

Mr. Richmond has given to the public much valuable information on the system of prepayment for gas. He has, however, either inadvertently or from a lack of knowledge of the fact, omitted to mention that the first real practical installation of prepayment meters was due in the first instance to Messrs. Marsh and Thorp, and afterwards to their licensees, Messrs. Sawer and Purves and the Automatic Meter Company.

At the outset, the system of supplying gas through prepayment meters met with a most chilling reception; and the writer canvassed personally every gas undertaking in the kingdom, and also brought the matter before their notice by letter and pamphlet.

The first practical and successful installation was one of a hundred meters that were fixed under a guarantee from the writer that he would remove them if not satisfactory, and pay all costs and damages that might follow upon the installation. Fortunately, the installation was a great success. The writer had the almost unanimous support of the Press; and it is due to Mr. Livesey, of London, to Colonel Robinson, of Liverpool, and to the writer, that the invention of Mr. Brownhill (to whom the greatest credit is due) was brought into actual use. The meter makers as a body stood aloof. They enjoyed the various difficulties that were put in the way of the parent makers; but immediately the battle was won, and the introducer had carried his way, then they rushed into the field to annex some share of the spoil. So-called prepayment-meter inventors became as plentiful as mushrooms in season; and the writer looks forward with confidence to the day of reckoning, when the real inventors shall reap their further reward, and when the imitators shall also receive their due.

58, *Lombard Street, E.C., Dec.* 3, 1898. THOMAS GARDINER MARSH.

Corrections.—In our report last week of Mr. Brearley's remarks on the subject of "Purification," at the meeting of the Manchester District Institution of Gas Engineers on the 26th ult., the amount of profit made (eighth line) should have been £13 18s. 10d. and not £18 13s. 10d.; and the estimated quantity of new oxide to replace spent oxide sold, 55 tons instead of 50 tons.

New Joint-Stock Companies.—The Automatic Lighting Company, Limited, has been registered with a capital of £10,000, in £1 shares, to acquire and turn to account any real or personal property, patents, patent rights, business concerns and undertakings, &c. The Incandescent Accessories and Maintenance Syndicate, Limited, with a capital of £2000 in £1 shares, will acquire the undertaking of the Wholesale Incandescent Fittings and Maintenance Company and the business of the London and Suburban Incandescent Maintenance Syndicate, and develop and extend the same. The Wholesale Incandescent Mantle Company, Limited, has been formed with a capital of £5000 in 4900 £1 ordinary shares and one deferred share of £100, to acquire certain patents relating to improvements in gas mantles and burners, and develop them. The Morton-Pringle Gas-Heating Company, Limited, has been registered with a capital of £30,000 in £1 shares, to enter into an agreement with the Morton-Pringle Gas-Heating Company, Limited (in liquidation), and C. A. Wright, the Liquidator, to carry on the general business of gas engineers, ironfounders, metal workers, &c., and to acquire and turn to account certain patents.

The Powers of the Tipton Gas Committee.—The Tipton District Council a short time since thought it necessary to clip down the powers of the Gas Committee to such an extent as to render them incapable of prompt action even in the most trivial matters; but the Committee have quickly convinced the Council of the folly of their proceeding. At a meeting of the latter body last Tuesday, the Committee reported that they had considered the difficult position in which they were now placed with reference to the carrying on of their business; and, feeling certain that serious loss and inconvenience would ensue in consequence, desired to call the attention of the Council to the matter, in order that they might take such action to obviate loss and inconvenience as might be most expedient. The Chairman and Mr. D. Hipkins illustrated the absurd position of the Committee by referring to two cases in which it had become necessary for them to take proceedings to recover certain debts, one being above £20; but the Clerk informed them that they had not the power to deal with the matter. Under the old procedure action would have been taken; and the money in all probability recovered. Mr. Doughty declared that all that was useful and beneficial had been swept from the Committee. He considered that the sooner the resolution recently adopted was rescinded the better it would be for the successful working of the department; and he proposed that the matter be regarded as one of urgency. The resolution having been carried, Mr. Doughty proposed that the Gas Committee have restored to them all the powers previously possessed. He remarked that the only objection to the old arrangement was that the Committee had the power to appoint officials, which he considered a paltry one. Mr. Millington seconded the resolution. Mr. Aston proposed as an amendment, and Mr. Moore seconded, that the Council adopt a resolution, drawn up by the Chairman, giving the Gas Committee all the powers they previously possessed, with the exception of the appointment of the office staff and the fixing of their salaries, borrowing money, making the gas rate, and entering into contracts. This was ultimately carried by 11 votes to 7.

PARLIAMENTARY INTELLIGENCE.

NOTICES OF APPLICATIONS TO THE BOARD OF TRADE FOR PROVISIONAL ORDERS (SESSION 1899).

Under the Gas and Water Works Facilities Act, 1870.

Alton (Hants) Gas.—The Alton Gas Company purpose making application for power to construct new works for the manufacture and storage of gas and residual products.

Bedworth Gas.—The Bedworth Gas Company, Limited, will seek authority to maintain and continue the existing gas-works in the parish of Bedworth, in Warwickshire, and supply gas, meters, fittings, &c., in the parish and in part of Astley. The exact limits, however, are to be defined, as is the share capital; and power to raise more money will be applied for.

Brigg Gas.—The Brigg Gas Company, Limited, intend to apply for power to maintain and continue their existing gas-works, and to manufacture and supply gas in the Urban District of Brigg, in Lincolnshire; also to sell gas in bulk, supply fittings and appliances, and generally carry on the business of a Gas Company. The existing capital is to be defined, and additional money raised. Authority will be sought to apply for a Provisional Order under the Electric Lighting Acts.

Burnham and District Water.—The Burnham, Dorney, and Hitcham Water Company intend to apply for power to raise additional capital, and to amend their Order of 1896, and any Acts or Orders relating to the Company.

Elstree and Boreham Wood Gas.—The Elstree and Boreham Wood Gas Company purpose applying for powers to raise further capital to the extent of £10,000, to meet the requirements of their business. They will ask for authority to supply gas in bulk, and to manufacture and sell or let on hire stoves, fittings, meters, &c.

Farnham Gas.—The Farnham Gas Company, Limited, intend to apply for power to maintain and continue their existing works, construct new ones, and supply gas in Farnham and Farnham Rural, in Surrey. The usual privileges will be sought, as well as authority to raise more capital.

Freshwater Gas.—Application will be made by the Freshwater Gas Company, Limited, for power to maintain and continue their existing works, and supply gas, meters, fittings, &c., in the parishes of Freshwater and Totland, in the Isle of Wight. The present capital is to be defined and the amount fixed, and authority sought to increase it.

Harlow and Sawbridgeworth Gas.—The Harlow and Sawbridgeworth Gas Company will seek authority to maintain their existing works and construct others, manufacture and supply gas or other means of obtaining artificial light, fittings, and engines, and levy rates and charges within the parishes of Harlow and Latton, in Essex, and Sawbridgeworth, in Hertfordshire. Permission will be sought to increase the capital and to acquire additional land.

Harpenden Water.—The Harpenden Water Company intend to apply for power to raise additional capital.

Herne Bay Gas.—Application will be made by the Herne Bay Gas Company, Limited, for authority to continue and extend their works, manufacture gas and residual products, and supply gas in Herne Bay and Herne in the county of Kent. They will ask for the usual power to open roads, levy rates and charges, &c. Provisions will be included with respect to the supply of meters, fittings, &c., and "engines and machines for the production of motive power for domestic, agricultural, manufacturing, and other purposes by means of gas." The existing capital, and any additional money authorized to be raised, are to be applied to these purposes. The Company will ask for power to hold patents for the production of artificial light by any means.

Hoylake and West Kirby Gas and Water.—Application will be made by the Hoylake and West Kirby Gas and Water Company for authority to raise additional capital, make provision for the protection of the works, property, and supply of the Company, prevent or prohibit the contamination and the waste and misuse of water, and impose penalties in respect thereof.

Laindon Gas and Water.—Application will be made by the Laindon Gas and Water Company, Limited, for authority to extend their limits of supply, raise additional water capital, erect gas-works and obtain money for the purpose, supply gas or other artificial illuminant (except electric light), meters, fittings, &c., sell gas in bulk, &c.

Limavady Gas.—The Limavady Gas Company, Limited, intend to apply for power to maintain and continue their existing gas-works, and works connected therewith, open streets, lay mains, and supply gas in the town of Limavady and the townlands of Rathbreadybeg, Rathbreadymore, and Killane, in the parish of Drumachose, in the county of Londonderry.

Maidstone Water.—Application will be made by the Maidstone Water Company for authority to raise additional capital.

Morecambe Gas.—The Morecambe Gas Company have notified their intention of applying for power to raise additional capital, and amend their Act of 1879.

Newtown and Llanllwchaiarn Gas.—This Company intend to apply for power to maintain and continue gas-works, manufacture and store gas and residual products, and supply gas, meters, fittings, &c., in the urban district of Newtown and Llanllwchaiarn, in Montgomeryshire. Provision is to be made with respect to capital and dividends.

Stourbridge Water.—The Stourbridge Water Company will apply for power to raise additional capital, extend their limits, sell water by meter or in bulk, and make provision for the prevention of waste.

Tilehurst, Pangbourne, and District Water.—The Tilehurst, Pangbourne, and District Water Company, Limited, purpose applying for power to raise additional capital, and amend their Provisional Orders of 1894 and 1896.

Tonbridge Gas.—Application will be made by the Tonbridge Gas Company for authority to maintain and extend their existing works, and supply gas within limits to be defined. Additional capital will be required.

York Town and Blackwater Gas.—The York Town and Blackwater Gas Company will seek power to construct and maintain works for the

manufacture and storage of gas and residual products, acquire lands, and increase their capital.

Under the Electric Lighting Acts, 1882 and 1888.

Applications will be made under the above-named Acts for powers in regard to the supply of electricity for lighting and other purposes in the following places: Alloa, Arbroath, Ashford, Audenshaw, Aylesbury, Barmouth, Barnstaple, Battersea and Fulham District, Bermondsey, Bethnal Green, Bexley, Blackheath and Greenwich, Bognor, Bournemouth, Brentford, Broadstairs (with Westgate and Birchington), Burslem, Camborne, Carshalton, Castleford, Cheltenham, Cheriton, Christchurch and Pokesdown, Clontarf, Cromer, Crowborough, Dairfield, Dukinfield, Dumfries, Durham, East Barnet Valley, East Retford, Eastbourne, Erith, Failsworth, Farnborough, Fenton, Finchley, Gateshead, Glossop, Gorton, Grays Thurrock, Guildford, Halesowen, Handsworth, Hartlepool, Haslemere, Haslingden, Hawick, Heaton Norris, Hendon, Heywood, Horsham, Hythe and Sandgate, Ilkeston, Inverness, Keighley, Kensal Town, Kensington and Notting Hill, Kent (West), Kilmarnock, Kirkcaldy, Knutsford, Leamington Spa, London (City, Holborn, St. Luke's, South-East), London County (East), Lewisham, Longton, Ludlow, Lye and Wollescote, Lymington, Maerdy, Mansfield, Marylebone, Merthyr Tydfil, Mexborough, Midland District, Mirfield, Musselburgh, Newcastle-under-Lyme, Newport, Newton Abbot, Partick, Pemberton, Penzance, Plumstead, Rathmines, Rawtenstall, Rhyl, Romford, Rugby, Runcorn, Ryde, Sandown and Shanklin, Shipley, Slough and Datchet, Sutton Coldfield, Stourbridge, Swinton and Pendlebury, Teignmouth, Twickenham and Teddington, Walker, Walton-on-Thames and Weybridge, Wath-upon-Dearne, Wednesbury, Weston-super-Mare, Winsford, Worksop.

NOTICES OF APPLICATIONS TO THE LOCAL GOVERNMENT BOARD (SESSION 1899) FOR PROVISIONAL ORDERS.

Under the Gas and Water Works Facilities Act, 1870, and the Public Health Act, 1875.

Ashburton Gas.—The Urban District Council of Ashburton will ask for authority to purchase the undertaking of the Ashburton Gas Company, and to manufacture gas and residual products, supply gas and fittings, purchase land, and levy rates and charges.

Kirkby Lonsdale Gas.—The Kirkby Lonsdale Urban District Council intend to apply for power to purchase so much of the undertaking of the Kirkby Lonsdale Gas Company as is situate within their district, and to manufacture gas and residuals, supply gas and fittings, levy rates and charges, acquire lands, and generally carry on the business of gas supply.

Wallingford Corporation Gas.—The Corporation of Wallingford will apply for power to purchase and carry on the undertaking of the Wallingford Gas Company, maintain and extend the existing works, and construct new ones, supply gas, deal in residuals, meters, fittings, and apparatus, and levy rates and charges. Provision will be made for winding up the Company and distributing the purchase-money.

Wokingham Corporation Gas.—The Corporation of Wokingham intend applying for authority to acquire additional lands and construct new works for the manufacture and supply of gas within the borough. Further borrowing powers will be needed.

Larne Gas.—The Town Commissioners of Larne purpose making application to the Local Government Board for Ireland for power to purchase the undertaking of the Larne Gas Company, and manufacture and supply gas within their district. It is proposed to extend the manufacturing plant and erect a gasholder of 50,000 cubic feet capacity. The necessary authority to borrow money will be applied for.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Dec. 2.

(*Before Mr. Justice* ROMER.)

Welsbach Incandescent Gas-Light Company, Limited, v. The Daylight Incandescent Mantle Company, Limited.

This was a motion for an injunction to restrain the defendant Company from infringing the Welsbach patent of 1885.

Mr. TERRELL, Q.C. (Mr. WALTER with him), who appeared for the plaintiffs, said the facts were much as usual, except the analysis of the mantle. It was substantially a zirconia mantle, which was one of the substances mentioned in the patent; and the judgment of the Court of Appeal was to the effect that if the class of substances mentioned in the patent were taken, it was an infringement.

Justice ROMER asked who appeared for the defendants.

Mr. TERRELL said he did not know that anybody did, but he had just been informed that Mr. Bousfield was instructed.

His LORDSHIP said Counsel had better mention the matter again later.

After a short interval, the motion was again brought forward.

Mr. BOUSFIELD not being present, Mr. GRAHAM, who was with him, suggested that the matter should stand over for a week, as it was a very important case, and it could not make much difference to the plaintiffs.

Mr. TERRELL said this was just the busy season, and even a week's delay meant a serious sum of money. Defendants were clearly within the four corners of the patent and of the judgment in the Court of Appeal, even upon their own showing.

Justice ROMER said if the motion was pressed he must hear it—at least to the extent of seeing whether or not it was a case for an interlocutory injunction. Mr. Graham was quite competent to look after the defendants' interests.

The proceedings were accordingly continued, and in a short time Mr. Bousfield came into Court.

Mr. TERRELL said there was no conflict as to what the defendants did. They procured a fabric, and steeped it in a solution of zirconia, with some magnesia and lime; then, after burning it, they dipped it in a solution of cerium, and so got a coating of cerium upon it. Not only did they use some of the substances mentioned in the Welsbach specification, but every one of them. The main ingredient was zirconium, and cerium was added for the purpose of giving light. Counsel then read the judgment of the Court of Appeal in the De Mare case, and submitted that the defendants came within it, and that the variation they made was merely colourable, so as to give them an opportunity of infringing the patent. It was one which could easily be infringed, and enormous sums could be made before a trial could take place. He relied on the defendants' affidavits, in which they said the analysis made by plaintiffs' witnesses was correct. The affidavit of Professor Lewes in fact described how they were made. One of the points raised in the De Mare case was that lanthanum was left out, and therefore they did not infringe. The patentee described three things, one of which was lanthanum. Then he said one of them might be left out, and something else substituted; and on this an argument was founded. In the present case, the analysis showed: Zirconium, 96·02 per cent.; oxide of cerium, 0·28 per cent.; and lime, 3·06 per cent. The only complaint the defendants made of the analysis was that it did not show the presence of magnesia. In the specification, it said that zirconium and magnesia might be used. He submitted, therefore, that these mantles were an infringement.

Mr. BOUSFIELD said he should have to call attention to the Sunlight case as well as the De Mare case. In the latter, it was decided that lanthanum was not essential (which was going a long way, but must be accepted now), though the specification said that one must either have lanthanum or an equivalent for it; and in the De Mare mantle there was not any equivalent for it at all. In the Sunlight case, it was decided that they must make a skeleton of zirconium and magnesia, and things of that kind, which were not rare earths. The mantle there complained of was one containing zirconium and aluminium, and it was made in precisely the same way as the Welsbach mantle; but it was held not to be within the specification. The light it gave was very feeble; but when it was sprayed with a solution of chromium, it was converted into a highly luminant mantle. Chromium was not within the class of bodies known as rare earths, which, according to the judgment of Mr. Justice Wills, were substantially the yttrium and cerium groups, probably, with the exception of didymium and cerium itself. It was distinctly held, therefore, in the Sunlight case, that it was open to anyone to use a mantle of zirconium, and something else like aluminium, and to make it into a light-giving mantle by means of something that was not a rare earth or within that class. Counsel then read a portion of the judgment in the Sunlight case, and stated that what the present defendants were doing was just the same, only they were coating their mantles with cerium instead of chromium. He then submitted that the oxide of cerium used in this case did not come within the class of rare earths, because, though present in cerite earth, Welsbach pointed out in his specification that, if this earth were used in place of lanthanum, care should be taken that it contained no didymium and but little cerium.

Justice ROMER asked if he was correct in supposing that Mr. Justice Wills's view was that the essence of the patent was to take a strong ground of zirconia and alumina, with or without magnesia, and then saturate it with either one of the cerium group or one of the yttrium group.

Mr. BOUSFIELD said he was, with this exception—that it was not to make it first and then saturate it, but all the salts were mixed together when the mantle was dipped. It was quite true that the zirconia and so forth were used to give strength, and the rare earths to give light. But they were all put into one solution, in which the mantle was dipped; and when it was burned off they had a skeleton of the mixed oxides. Mr. Justice Wills held that the rare earths were the essence of the patent. Cerium was one of the rare earths; but it was one of those excepted in the patent. Having read a portion of the Welsbach specification,

Justice ROMER said the substantial question seemed to be whether the defendants were using cerite earth.

Mr. BOUSFIELD then read the affidavits of Mr. Mackean, Mr. Ballantyne, and Professor Lewes. The last-named gentleman said that cerium was not given in Welsbach's specification as one of the permissible equivalents; its presence being at that time supposed to be very injurious to the light, and to give it a yellow colour. In his opinion, the mantle of the defendants was not an infringement of the Welsbach patent.

Justice ROMER said he should like further expert evidence directed to the exact point of what chemists would understand by cerite earth. Did it contain lanthanum.

Mr. BOUSFIELD said lanthanum was its chief constituent; he thought his friend and he would agree about that. But, before going more deeply into the question, he would ask his Lordship if he thought this was really a case for an interlocutory decision.

Justice ROMER said he did not. It was a case for advancing the trial, because he could see it was rather pressing; and the defendants, of course, would keep an account.

Mr. TERRELL pressed his Lordship to hear the motion; saying the plaintiffs' business was being seriously interfered with, as the defendants were selling at a lower price, and in some cases keeping an account did not answer any useful purpose.

Justice ROMER, however, said he could not decide such an important question on an interlocutory application. The case might be mentioned on the first day in next sitting; and he would then fix an early day for the trial. He should then want to have evidence as to what the state of knowledge was at the date of the patent, as to the effect of a slight trace of cerium.

PRESTON (ADJOURNED) QUARTER SESSIONS.

Friday, Nov. 25.

(*Before the Chairman, Mr.* W. H. WORSLEY-TAYLOR, Q.C., *and other Magistrates.*

The Assessment of the Rossendale Union Gas Company.

This was an appeal by the Rossendale Union Gas Company against the Assessment Committee of the Haslingden Union, in respect of a poor-rate.

Mr. BRADBURY and Mr. M'KEAND appeared for the respondents; and Mr. SUTTON and Mr. FORMBY, for the appellants.

Mr. BRADBURY said that the appeal was by the Rossendale Union Gas

Company against the Assessment Committee of Haslingden Union and the Overseers of the township of Rawtenstall. It was against a supplementary valuation list deposited on March 17 last, and proved on April 20. The figures appearing in the valuation list showed that in the Rawtenstall assessment, the net rateable value was £5369; but it was necessary, in considering these figures, to refer to a second case in which the Company appealed against the Overseers of the township of Bacup. The Bacup rateable value was put at £2502—making a total of £7871. On June 10, the Gas Company gave notice of objection, to the effect that the premises were assessed at a higher sum than they were legally liable to be rated and assessed at; and they also contended that the works were assessed at a greater amount than they might be reasonably expected to be let for, year to year, free from all tenants' rates and taxes. Appellants went before the Committee on Aug. 3; and this body, after hearing both sides, decided to reduce the Rawtenstall assessment to £5100, and Bacup to £2377—making a total of £7477. It was against this assessment that the appeal was now made. The assessment of the Company, down to 1898, was upon a valuation made in 1888 on the accounts of the Company for 1887. At this time, and down to the present increase, the matter stood this way: Rawtenstall was assessed at £4659, and Bacup at £1700—a total of £6359, as against £7477. This, of course, was a substantial increase in the rateable value; but one reason for it was that the township of Spotland, which in 1883 was partly in the Rawtenstall Union and partly in the Haslingden Union, had since been transferred entirely to the Haslingden Union.

The CHAIRMAN: Is Spotland in the Company's district?

Mr. BRADBURY: Yes.

The CHAIRMAN: There are works of the Company in the Spotland district?

Mr. BRADBURY: Yes.

The CHAIRMAN: Which at the time of the 1888 valuation was outside the present area?

Mr. BRADBURY: Yes, but has since been brought in.

The CHAIRMAN: Are you going to give the rateable value of Spotland.

Mr. BRADBURY: I have not got it.

Mr. SUTTON: I think it was £427 net.

Mr. BRADBURY said this would bring the rateable value in 1888 to £6786, as against the £7477, which would leave the increase at something like £700. This, of course, did not allow in any way for the increased business of the Company and the increased expenditure by way of landlord's capital which had taken place since 1887. The undertaking had not remained stationary. The Company had spent a great deal of money, first of all, on permanent works. Learned Counsel believed they had built new offices at Bacup, at a cost of something like £2000; and there had also been an extension at Clough Fold, Rawtenstall. The increase of the business, receipts, and profits, was best shown by the following figures: In 1887, the gross receipts were £28,628; and the working expenditure, £16,051—leaving £12,577 as balance of receipts. In 1897, the gross receipts were £34,470, and the working expenditure £19,576—leaving a balance of receipts of £14,894. The balance of receipts therefore showed an increase of 18½ per cent. Of course, the total increase of £2317 had to be divided between the landlord and tenant. What the Court had to consider was the proportion of increased rate to increased receipts. Respondents were not increasing the rates without good cause; for while they had raised the rateable value, there had been a total increase of £2317, of which respondents said the landlord received £1100. In arriving at the rateable value, the mode adopted was to first ascertain the gross total receipts of the undertaking. From the gross receipts were deducted the working expenses, which gave the balance of receipts, out of which fund the landlord and tenant and rates were paid. The first deduction made was the tenant's share. He had a share of the profits taken off for what was known as interest, profit, and risk on his capital—proper remuneration for risk as the carrying on of such a business as this entailed. The tenant's remuneration was taken at a percentage upon the amount of capital he employed in the undertaking; and it was here that the great bone of contention came in. The rate of interest usually allowed was abnormally high, for the tendency of a tenant in cases of this kind was to swell his capital by any means he could. What was the proper figure to allow for tenant's capital?

The CHAIRMAN: What have you taken the figure at?

Mr. BRADBURY: We have taken it at £15,477. We have allowed what I think I shall satisfy you is a liberal figure—indeed 17½ per cent. on the whole of the capital employed.

Mr. SUTTON: We accept that figure.

The CHAIRMAN: Then the dispute will be about the capital account?

Mr. BRADBURY said it would. They had allowed 17½ per cent. upon the whole of the capital; and it was obvious, having regard to some of the items of the capital, that this was an absurdly high figure. There would be great dispute as to the amount of capital which the tenant employed in furnishing his place with coal and other products used in the manufacture of gas. If the tenant was to have this very liberal allowance of 17½ per cent., his capital account ought to be scrutinized most strictly. It was not right to swell the capital, and in addition to have this 17½ per cent., which was an absurd rate of interest to be derived from a concern of this kind. At the time this figure was fixed, capital bore a very different rate of interest to what it did now. Then from the balance of receipts they had to arrive at the figures for the rates; and the amount left went to the landlord. A proper sum was allowed for the renewal fund; and the balance was the net amount which the landlord put into his pocket. The tenant did repairs, which were included in the working expenditure. The landlord's renewal fund came as a last deduction, and from this they obtained the net rateable value. This was the principle upon which the respondents had gone. The valuation based upon this principle showed the rateable value for the whole undertaking to be £8541, which was something like £1000 in excess of the figure already given to the Court. The amounts upon which the figures of the rating agent, Mr. Cross, were based were the Company's own accounts for 1897; but the figures upon which the supplementary valuation list was made out were the 1896 figures.

Mr. SUTTON: We accept the 1897 figures.

Mr. BRADBURY remarked that this might account for the difference between Mr. Cross and the Assessment Committee. The figures were these: He first of all took the gross receipts—after allowing discounts for bad debts—which came to £34,470; working expenditure, including certain renewals, but not rates and taxes, £19,576; balance of receipts for landlord, tenant, and rates, £14,894; tenant's share on capital of £15,477, at 17½ per cent., £2708—leaving a balance of £12,186. From this had to be deducted annual sinking fund and insurance, to provide for the renewal of such perishable goods as had not been renewed out of the current expenditure, £1332, which left £10,854. Then rates were deducted at 5s. 5d. in the pound on the net rateable value (£2313); leaving a net rateable value of £8541. This was the principle, and those were the figures by which the hereditament had been assessed. For the information of the Court, he thought he might indicate one or two points whereon he gathered the difference arose. The respondents' figures were based on the Company's books; but in dealing with the revenue account, they found great difficulty in separating what were strictly charges against revenue from what ought to be charged against capital. Therefore they had been obliged to make certain corrections. The total receipts (£34,000) were, he believed, the same as Mr. Newbigging's figure; but there was a dispute in regard to the working expenditure, and the discrepancy arose in this way: There was first of all a matter of something over £1000 debited for cost of furnishing new offices at Bacup. Obviously that was a capital charge, and ought to go, not against the revenue account, but against the capital account. In the accounts for 1897, a large sum was charged for new gas-meters, which ought also to be put against capital account. The meters had to be repaired and maintained out of the working expenditure; and where they had, as in this year, an abnormal expenditure, it was improper to charge the whole of the outlay to revenue. The respondents had allowed £510, which they regarded as a fair and ample sum to cover the replacement of old meters. In the working expenditure, there was another item of difference. The Assessment Committee deducted something like £800 more for rates and taxes than did Mr. Newbigging—the respondents' figures being £2313, as against £1520—but they allowed it in another place. His (Counsel's) expenditure account allowed a fund for the renewal, properly so called, of meters, retorts, mains, and service-pipes. It did not matter whether they were taken off in the expenditure account or afterwards; but they must not take them off twice. Then with regard to the tenant's capital, a considerable question of principle arose. The sum which was allowed by the Assessment Committee for tenant's capital amounted to £15,477, which was made up of the following four principal items, upon which disputes might arise: Tenant's capital, four months' current expenditure, £7060; stock, £1058; meters, stoves, &c., £6759; and tools, implements, and furniture, £600. The first item was the floating capital which the tenant needed to carry on the business. The problem was what capital was required to carry on the undertaking from Jan. 1 to May 1. No man in the ordinary way of business would provide capital for his March coal bill, because he would trust to his revenue coming in in May. But while the gas bills only became due once a quarter, another very important item—namely, the sale of residual products—went on all through the quarter. During the year under review, the sales of residual products amounted to £4341. As the Company bought the coal, so they sold residuals, which were a considerable portion of the gross receipts. Therefore four months' capital was really more than was required.

The CHAIRMAN: Has Mr. Cross estimated on the principle of four months?

Mr. BRADBURY: Yes. The total expenditure is £19,576. Mr. Cross's item for the four months is £7060, which is more than one third of the total expenditure.

The CHAIRMAN: Mr. Cross allows four months, and he also allows the tenant the money accruing from residuals?

Mr. BRADBURY said that was so. Taking one-third of the residuals, the amount would be £1441. Stock, coal, and other materials used in the manufacture of gas furnished another item wherein there existed a considerable difference of opinion. The greatest difference in figures was with regard to meters. Mr. Newbigging's amount for meters was £13,484, which he contended was the price of them when new.

The CHAIRMAN: Is there any dispute about the figure? Do you accept it, Mr. Sutton?

Mr. SUTTON: I do not accept this way of dealing with the figures at all. I protest against it.

Mr. BRADBURY: Our figure is £13,518. The important difference is how the figure is dealt with. Supposing a hypothetical tenant is taking the gas-works in their present condition, what capital would he require? The meters are tenant's fixtures. At what rate does he take them? Not at the original cost. He would not require capital to buy so many thousand new meters, but would purchase at the current value. You have to arrive at the average value; and we have taken half the original cost.

Mr. SUTTON: You asked me if £13,484 was the cost of the meters. No; the price of the meters when new, and not the whole of them, was £16,114.

The CHAIRMAN: On the question of depreciation, of course, there may be differences of opinion.

Mr. SUTTON: I am willing to give you our figures. The cost was £16,114, from which we have taken 32½ per cent. This leaves £10,867.

Mr. BRADBURY then discussed the sinking fund, whereon he said there was also a difference of principle. To ascertain the annual sinking fund which would enable the landlord to renew his premises from time to time, they had estimated the life of the different constituents in the landlord's capital—including buildings, gasholders, tanks, machinery, &c. Mr. Cross valued the landlord's capital account at £105,205; and the sum required, on the 3 per cent. table, to produce this amount in 42 years (which he believed to be the average life of gas undertakings) was £1282. By adding £50 for insurance, the figure was brought up to £1332.

Mr. *John Cross*, of Manchester, gave evidence bearing out Counsel's statement. He had valued the Company's undertaking on several occasions. Since the valuation in 1888, new offices had been erected and furnished at Bacup. The revenue of the Company had increased considerably. The gross receipts in 1887 were £28,628; in 1897, the same items were £34,470. The figures for working expenditure, not including rates, discounts, &c., for the same period, were £16,181 and £19,576 respectively. The slight reduction of the Assessment Committee in March, 1898, was made for the sake of peace, and not because there was any need for it. The actual rate, at 5s. 5d. in the pound upon £8541, amounted to £2313. Of the total revenue of £34,470, £4341 was for residual products. The total gas-rental was £30,727. Discounts and bad

debts amounted to £1301, leaving as net gas-rental £29,496. Of course, the discount allowed for early payment was taken off in the sum of £1301. Meters and stove rents in this particular year produced £665. Some of the items, from a revenue and rateable point of view, had not been accurately charged. For instance, building and furnishing new offices, £1038, ought not to appear in the revenue account. For working expenses he allowed £20,138, from which sum he deducted £562 as improperly charged to the revenue account. Repairs and maintenance included £3048 for the renewal of retorts; and from this amount he deducted £1038. Before he knew what the item of £3048 was composed of, he allowed one-third of the amount, whereas he ought only to have allowed one-third of the balance of it. Some of the residuals were ready money—coke, for instance. But perhaps this applied more to large towns. The stock of coal and sundry stores in December, 1897, he wrote down at £1058; and tools, implements, and furniture, at £600. Many of the Company's meters were of considerable age. Some had been sold for as little as 2s. each; and he contended that they were not worth more than half the sum charged to capital. The price of the meters used by the Company would range from 19s. to 30s.

Mr. SUTTON (in cross-examination): Are you aware that there has been a large reduction in the price of gas to consumers from Jan. 1, 1898?

Witness: No; I have taken the accounts for 1897.

Then you have not taken into consideration the reduction at all?—No; I was not aware of it.

Do you know that there is a Bill before Parliament for electric lighting in this district?—No. Electric lighting schemes have not resulted in a reduction in the consumption of gas.

Cross-examination resumed: He had allowed £1068 for purification; £1396 for actual salaries; and £4719 for wages. He had included in the expenditure, repairs of retorts and renewals, which he considered was a right course to pursue. He knew it had been stated, but as a rating expert he did not accept the statement, that 3d. per 1000 cubic feet of gas sold represented the cost of keeping in repair the works, plant, &c., of a gas company, exclusive of retorts. He could not say how much of the total expenditure of £21,676 was to be attributed to the repair of retorts. The collection in the fourth month amounted to from 75 to 80 per cent. of the gas-rents; and he could not believe that the remaining 25 per cent. was often outstanding for a considerable time. Before the winter season commenced, the stock of coal ought to be larger than at other times, but not at its largest.

Mr. SUTTON: I suggest to you that eight weeks of the maximum daily consumption is not an unreasonable quantity of coal for the hypothetical tenant to have at the beginning of October?

Witness: I say it is outrageous. I allow him four months' coal to begin with; and he wants eight weeks more.

In further cross-examination witness said he had not allowed anything for railway waggons; but for sundry stores and stocks he had adopted the figure in the balance-sheet—namely, £1058. If he endeavoured to ascertain the value of the meters by taking the original cost price and striking off a certain percentage each year, it would come to a less sum than he had already put down. He had allowed £876 for repairing, renewing, and replacing meters. The retorts were part of the landlord's property. The repairs must be deducted somewhere; and witness deducted them in the working expenses. In his opinion, the sum was sufficient to provide for a renewal of two-thirds of the mains. He did not accept Counsel's suggestion that 30 years was the average life of a gas-works; for his own figure of 42 years was less than the actual life. Part of the works had been in existence since 1835. The Cloughfold works were established in 1854; and there was no renewal fund yet. It was true the new buildings at Bacup had been erected on the site of the old offices. Except for the years 1896 and 1897, he had not looked at any of the Company's books; but he perused the balance-sheets for many years.

Mr. *Henry Edge*, Chartered Accountant, of Blackburn, said he had been through the appellants' books. He found items of capital expenditure in the revenue account. His investigation revealed a large sum charged to revenue every year that should not have been so charged.

Cross-examined: The books did not show that anything had been put by for depreciation of meters. The Company kept buying meters, and charging them to stock account. The net profits to June, 1898, were about the same as in 1897, so that the Company had not suffered much from the reduction in the price of gas.

Mr. *T. T. Wainwright*, Surveyor and Valuer, of Liverpool, bore out Mr. Cross's evidence as to the expenditure account including the items he had deducted as charged to capital. The sums of £1038 and £562 ought not to be charged to the revenue account. In valuing meters for capital account in the absence of evidence as to age, it was necessary to divide the capital by two. This question was continually exercising the minds of valuers. In his opinion, four months was a sufficient time to allow for current expenditure.

Saturday, Nov. 26.

At the commencement of the proceedings this morning,

Mr. BRADBURY put in an extract from the Company's ledger, showing the bank balance for 1897.

Mr. *Wainwright*, further examined, said he did not agree that the hypothetical tenant should have a stock of coal in hand to the value of £3000, to provide for a possible strike. The 17½ per cent. on the tenant's capital covered any such risk.

Mr. *Edge*, recalled, handed in a statement showing the bank balances for and against the Company at the end of each month in 1896 and 1897. The additions to the capital account for meters between 1888 and 1896 were as follows: 1896, £12,183; and 1888, £10,986—being an increase of £1197. The sum of £200 odd chargeable to the 1897 working expenses for station meters was not, in his opinion, properly charged. If charged to this account at all, it should have been spread over several years.

This closed the respondents' case.

Mr. SUTTON announced that he would call his witnesses first, and then address the Court.

Mr. *Thomas Newbigging* was called, and explained his principle of valuing. He took the gross receipts; and from these he deducted the expenditure. The balance left represented the net receipts which had to be apportioned in some way between the landlord and the tenant. In order to find out how much of these net receipts were due to the tenant, it was necessary to determine the amount of capital he would require to rent the concern; and having arrived at this sum, they made the usual allowance—5 per cent. for interest, 10 per cent. for trade profits, and 2½ per cent. for risks. Whatever this came to was deducted from the net receipts, and the figure left was the gross estimated rental—viz., the amount of rent the tenant would pay to the landlord. The landlord had to maintain the works in a state to command this rent; and he had to provide a sum of money to reproduce, not the mere buildings and mains, but the capital invested in the concern at the end of its life. The life of a gas-works was, on the average, 30 years; and they had to provide a fund which, invested year by year, would reproduce the whole of the capital at the end of this period. Having arrived at the amount necessary for the fund, it was deducted from the gross estimated rental; and the sum left represented the rateable value. He had taken the actual figures from the Company's accounts, but there were certain adjustments to be made. The gas-rentals amounted to £30,727, from which sum he deducted £1301 for bad debts and discounts; and, in addition, he also took the reduction in the price of gas. On an average, this reduction was equal to 1·43d. per 1000 cubic feet sold—amounting to £1101—and, added to the discounts and bad debts, totalled to £2402, which left a net rental of £28,325. Other receipts included rents for gas-meters, £500; rent of stoves, £100; residuals, £4341; and profit on fittings, £48. Profit on fittings had nothing to do with hereditament; but he left it in. The gross receipts were £33,369, as against Mr. Cross's £34,470; the difference being accounted for by the £1101 due to the reduction in the price of gas. As a matter of fact, the consumption for the first six months of this year was a quarter less than it was in 1897, notwithstanding the reduction. It had been stated that, in spite of the reduction in price, the profits of the Company for the half year to June last were equal to those in the corresponding period of 1897. This was so; but it did not arise from increase in the consumption of gas. It arose in this way: There was £1000 less spent in repair of works; £200 less for repair of mains; £50 gained in the residuals; £10 gained in the fittings; and the discounts were £336 less, owing to their having been reduced from 5 to 2½ per cent. These items added together made £1595. But there was an excess paid for rates and taxes of £236, which, deducted from £1360, accounted for the profits being nearly as much as they were in the half year ending June, 1897. Turning to the expenditure account, there was little difference between them except in the matter of purification. This was a fluctuating amount. The usual cost of purification was from ½d. to 1d. per 1000 cubic feet; but witness had allowed 0·21d. In the matter of tenant's repairs to works, mains, and plant, witness took it at 3d. per 1000 cubic feet sold. This was a figure which experience showed was required. It was always necessary to average these repairs, because some years they were very trifling, while at other times they were extremely high. For example, in 1892 repairs cost 4·64d. per 1000 cubic feet; in 1893, only 3·48d.; in 1894, 8·07d.; in 1895, 5·58d.; in 1896, 6·79d.; and in 1897, 5·44d. So it was necessary to adopt an amount which would represent the average. Taking these figures, witness said 6d. per 1000 cubic feet was a fair average all round—3d. going to the landlord, and the same sum to the tenant. He had taken a figure which was a fair average, not including the extra expenditure challenged by Mr. Cross. In his opinion, 0·6d. per 1000 cubic feet of gas sold would be sufficient to repair, renew, and refix meters at the end of life. This, in fact, was a less sum than Mr. Cross allowed, basing his estimate on the years 1895 and 1896. The amount in the books for the repair of meters during the year was really £876; but witness's figure was only £462. So that here again it might be said that part of the meters should be charged to capital. This might be so; but he (witness) had no necessity to take it into account. He adopted a figure which would repair and reproduce the meter value at the end of its life; and this figure was 0·6d. He did not allow the restoration of the retorts to be taken into the accounts of the expenditure, which he considered was a landlord's charge; but he did take into account the rates the tenant had to pay.

Mr. BRADBURY: I understand the retorts are renewed every year.

Witness said that was not so; but even if they were, it would not be a landlord's charge. They lasted on an average three years. It was true the rates worked out to nearly 5s. 5d. in the pound; but Mr. Cross had included rates paid on some cottages, which ought to have been deducted, because they were separately assessed. As to the working capital of a gas company, it was important to bear in mind that there was a great difference between a gas and a railway company. On the one hand, a railway received revenue day by day, and had no bad debts; whereas the gas company received very little until the expiration, certainly, of four months. The appellant Company covered a wide district; and their expenses were heavier than in the case of a company confined within a narrow area. Instead of four months, he allowed five for working expenses; and he did so because five was an average figure. Take a winter quarter, the consumption of gas during October—or rather the make—was 18,714,000 cubic feet; in November, 26,951,000; and in December, 32,247,000. Now these were the three heaviest months of the quarter; but no money came in until the very end of January. The January consumption was 30,228,000 feet; and the four months added together gave a total of 108,140,000 feet, while the make for the whole year was 201,840,000 cubic feet. The make of gas for the four months under review was therefore actually 53·57 per cent. of the year's make; and 53·57 per cent. of the expenditure for the year (£20,602) amounted to £11,036. The average monthly expenditure was £1716, so that the amount the tenant would have to expend during the four months, before he received one farthing—or at least only a trifling sum—was equal to 6½ months of the year. The five months' expenditure would amount to £8584, as against Mr. Cross's figure of £7060. Witness was strongly of opinion that, in addition to the average consumption, there ought to be eight weeks' maximum daily consumption of coal. It would never do to work from hand to mouth. Two or three years ago six weeks' store was considered sufficient; but since the strikes, the period had been raised. Colliery proprietors would not make a contract now without a strike clause. Railway waggons had been disallowed by Mr. Cross; but witness had taken the twenty waggons at £55 each, which, after a depreciation of 25 per cent., left a net value of £825. New ordinary and prepayment meters in stock, on hire, or in repair, worked out to a total of £11,439. Although the life of a meter was put at from 25 to 30 years, meters, in witness's opinion, enjoyed a permanent life. They never wore out; and the Company charged meter-rents upon the new value of the meters, and not on the depreciated value. As a concession to the ideas of some of the

valuers, he had taken 15 per cent. off. He had entirely ignored the old meters, because they were of no value until repaired. He could not see any justification for Mr. Cross's method of depreciating the meters, for by this means the Company would be throwing away half of their capital expended on them. The tenant should have capital in hand to pay his quarter's rent, because he was always a quarter behind. The present structural value of the hereditament, not including land, was £114,000; and a fund must be set aside to reproduce the capital value in 30 years. The rateable value of the whole was £5404.

Cross-examined by Mr. BRADBURY: The hypothetical tenant would not need directors; but he would have to bear certain expenses for his 17½ per cent. If he charged a salary for his own time, witness thought he would be entitled to do so. He was not aware that during 1897 the Company sold old meters to the value of £105. He agreed with Mr. Cross that a fourth of the residuals ought to be deducted. The £114,000 was the original cost value of the undertaking. The Company put by £2300 as a renewal fund, by spending it on renewals.

By the CHAIRMAN: As far back as 1870, when he managed the appellant Company, and the consumption of coal was about half what it was now, he used regularly to have a stock of 4000 tons.

Mr. *Corbet Woodall* said, with regard to the alteration in the price of gas, the tenant going into the premises would make inquiry as to the rate he would charge. It was in the matter of the distribution of the net receipts between tenant and landlord that the real question arose. He did not agree with Mr. Newbigging that it would be necessary to hold the coal in stock all through the year. In the lighter part of the year, the stock might be reduced. The custom with all companies in regard to meters was to keep them up as they maintained the whole undertaking, so that Mr. Newbigging's perennial theory was a perfectly just one. Dealing with the question of the 17½ per cent., witness said to offer a person £2700 a year for interest on his capital in an undertaking crowded with risk, would be looked upon by the average man as a joke. He suggested that in such a case £5474 was not by any means a large return. After the statutable deductions, he gave the rateable value of the whole undertaking at £5055. He had no experience of the practice among Lancashire gas companies as to stocking coal.

Wednesday, Nov. 30.

When the hearing was resumed to-day,

Mr. BRADBURY explained that the case was adjourned in order that the respondents might investigate the question of the meters, for which purpose the Company had given every facility.

The CHAIRMAN: Have you not been able to agree upon a figure?

Mr. SUTTON: Yes; our figures were rather less than the numbers found in the books.

Mr. BRADBURY: So far as numbers go, I do not think there is any real dispute; but as regards Mr. Woodall's figures, there certainly is a dispute. Mr. Woodall charges a total sum of £2394 for taps and fixing of taps. I want to show, with reference to this and other items, how in point of fact they are treated in the books.

Mr. *Edge*, re-called, said up to nine years ago taps, fittings, and fixtures were charged by the Company to capital account.

Cross-examined: He could not say whether the taps went when the meters were taken away; and he was unable to state whether 10,186 was the total number of meters on hire, as shown by the Company's books, as compared with Mr. Newbigging's figures of 10,127.

Mr. *Cross*, re-called, said that the tap on the service-pipe was essentially a part of the supply-pipe, and not of the meter.

Mr. SUTTON: Have you made inquiries to ascertain whether the Company leave the taps on when removing the meters?

Witness: I do not know what the Company do. The practice is to leave the taps.

Your statement is entirely in contradiction to Mr. Woodall, that the usual custom is to take away the tap?—I contradict that.

In answer to further questions, witness said that in his previous items in the account for working expenditure he had allowed the amount charged in the books for new meters, but had deducted £510 because the sum charged in that particular year was excessive. It was a capital outlay.

Mr. *Wainwright* agreed with Mr. Cross's evidence as to the taps. When meters were taken out in Liverpool, it was the custom to leave the taps behind.

Mr. *Newbigging*, in answer to Mr. SUTTON, said the invariable practice was to unscrew the tap off the service-pipe, because it would not be safe to leave it there. On an average, the value of the tap was 2s. 6d.

Mr. SUTTON then proceeded to address the Court on behalf of the appellants. He urged that they were there to ascertain the rate at which hereditaments might reasonably be expected to let from year to year, free of all usual tenant's rates and taxes, tithe commutation, and rent-charge, and deducting therefrom the probable average annual cost of the repairs, insurance, and other expenses necessary to maintain them in a state to command such rent. He quoted the words of Lord Herschell in 1893 in the case of the Sheffield Gas Company, wherein the difficulties of dealing with such rates was commented upon, and his Lordship stated that the only course the Court could adopt was to adhere to the principle laid down in *Regina v. West Middlesex Water-Works Company*. In the present case, there were certain difficulties which did not arise in regard to railway companies and undertakings of that character, because Acts of Parliament had introduced a set of provisions which made dealing with gas-meters entirely different. Hitherto the authority which had been considered the foundation was the Lee case, where it was laid down that meters were tenant's capital. The rates and taxes were made part of the tenant's annual expenditure; and Counsel could not see how it could be contended that they could be dealt with otherwise than as part of the expenditure which must come from the tenant, because the Act distinctly stated that it was to be "free of all usual tenant's rates and taxes." It was in consequence of Mr. Cross introducing the retorts into the expenditure, and cutting out the rates and taxes, that one of the great difficulties in the case had arisen. It was true the Company submitted to the rate of 1887. Gas companies were not anxious to fight these expensive cases; and while strongly advised that the rate was in excess of what they ought to pay, they submitted. But when on the top of this the Company were still further rated, they found it necessary to ask the Court to assess the fair rateable value of the undertaking. It must be remembered that the Court were not dealing with the profits in any sense, except for the purpose of ascertaining what rent would be given for the hereditament. It was on the question of expenditure that he considered the valuers for the Assessment Committee had gone wrong. In omitting rates, they had ignored the Act; and bringing in the repairs of retorts, was not in accordance with the decision in the Lee case. Certainly £300 was a small enough sum to give to any hypothetical tenant who undertook the management of such an important concern as the Rossendale Gas-Works. In the Southampton case, which was decided when Lord Chief Justice Cockburn was Recorder of Southampton, it transpired that a sum of £1000 had been originally paid to the Directors of the Southampton Docks; but in consequence of the rather unfortunate financial position of the docks, the amount was not handed over for a few years. Nevertheless, the Recorder allowed the sum for the hypothetical tenant; and the Court of Queen Bench upheld his decision. Dealing with the thorny question of repairs of works, mains, and plant, Counsel submitted that it was not right to base the calculation simply on the books for one, two, or three years. They should ascertain the probable average in a wider and more scientific manner. Discussing the working expenses, he urged that the tenant must be prepared with capital sufficient to enable him to meet the outlay at the period of largest gas consumption. It could not be disputed that October, November, December, and January constituted the busiest four months of the year. In fact, the expenses during these four months were admittedly equal to six and a half average months. The Company, however, had only taken five months; and in doing this they adopted a very fair and reasonable proportion. With regard to the stock of coal, the Company ought to have in hand 6216 tons. If the Company had not kept up such a stock, they ought to do so, in order to safeguard themselves against possible strikes and other contingencies. The omission on the part of the respondents to include the Company's railway waggons in the working expenses, threw a very strong light on the way in which the case had been got up for the Assessment Committee.

Mr. BRADBURY: The Company entirely omitted any reference to them; and that is the reason they were not put in.

Mr. SUTTON, in conclusion, pointed out that, by section 19 of the Gas-Works Clauses Act of 1871, the Company were bound to keep the meters in thorough repair.

Mr. BRADBURY, in reply, said that because Directors' fees were allowed in the Southampton Docks case, it was no reason why they should be granted in the present instance. He contended that the question of Directors was mixed up with the total salaries and expenses of the concern. The figure Mr. Cross allowed in respect of these salaries was very high. For salaries of Secretary, accountants, and clerks, he put down £671; and for engineers, &c., £425. Apart from the Directors, therefore, there was a sum of over £1000. The hypothetical tenant would have no Directors; and if he was getting 17½ per cent. on his capital, he would not be allowed anything beyond that. As to the tenant's capital, Counsel urged that their evidence as to how the coal was bought and payments made had not been touched at all. The hypothetical tenant ought not to take four winter months' supply, but three. With regard to the inclusion of rates and taxes in the working expenditure, he thought Mr. Sutton must have been somewhat misled by the case he had quoted, for he (Mr. Bradley) did not find anything which said that the rates and taxes, although relied upon by the Company, were allowed by the Court as expenditure. The material point in the present appeal was whether a tenant ought to be allowed interest on capital provided for the purpose of paying rates and taxes; and he asked the Court to say that, conducting his business in an ordinary way, a tenant would have money wherewith to pay the rates, and would not include them as part of the tenant's expenditure. He appealed to the Court to deal with the matter as business men, and not to allow the Company to swell their capital on the fanciful hypothesis of what an imaginary tenant ought to do, but what no commercial man ever did. In conclusion, he reminded the Court that in 1888 the Company were rated upon one-half of the net receipts, and there had never been a single objection to that assessment. If the proportion of 50 per cent. was correct in 1888, why was there not the same right to a similar proportion in 1897?

The Bench retired, and were absent a considerable time. On their return,

The CHAIRMAN said: We have to deal only with the total rate of £7477, which we affirm.

Mr. BRADBURY: The appeal will be dismissed with costs.

The CHAIRMAN: Yes. I do not know how the amount will have to be apportioned.

Mr. BRADBURY: The apportionment will have to take place; and if any question arises, it will have to come before you again.

Mr. SUTTON: How about the Bacup case?

The CLERK OF THE PEACE (Mr. Hutton): According to the rateable value, Rawtenstall is £5100, and Bacup £2377.

Mr. SUTTON: I understand that all that has been affirmed is that £5100, *plus* £2377, is the aggregate rateable value of the whole.

The CHAIRMAN: All we have decided at present is the £7477.

GREENWICH POLICE COURT.—Wednesday, Nov. 30.

(*Before Mr.* G. G. KENNEDY.)

London County Council v. South Metropolitan Gas Company.

The Question as to Exemption of Gas-Works from the London Building Act.

Judgment in this case was delivered to-day. The Company, it will be remembered, were summoned by the London County Council for an infraction of the London Building Act, 1894, by the erection of a coal-shed at the Rotherhithe Gas-Works within the prescribed distance of 20 feet from the centre of the roadway, and without having first obtained the consent of the Council. The Company claimed that, under clauses of the Building Act itself, they were exempt; and, furthermore, that the Surrey Consumers' Gas Act of 1854 made it lawful for them to construct "such houses, buildings, and approaches upon the lands belonging to them, or which they may acquire under the powers of this Act, and to make and supply gas, or to contract for the making and supply of gas in such manner as they shall think proper," &c. A report of the arguments of

Counsel, and the evidence adduced at the hearing of the action, was published in the "JOURNAL" for Nov. 22.

His WORSHIP, in giving his decision, said he had carefully considered the case, and had come to the conclusion that the Company could not claim exemption from the provisions of the Metropolitan Building Act, either by virtue of their Special Act, or because the land on which the building was erected was their own curtilage. Therefore the County Council would obtain the order they sought. There would be a nominal penalty of 40s. He had also had to consider that very odious question of costs; and he thought 15 guineas should be payable in this case by the defendants.

On the application of Mr. C. F. T. BLYTH, his WORSHIP consented to state a case.

Mr. BLYTH asked his Worship if he would say what he found as to the question of the building being necessary.

His WORSHIP replied that he held it to be a necessity, and so decided that point in the Company's favour. Any other questions of fact he would consider hereafter.

Tampering with Water-Pipes.

At the Wakefield West Riding Police Court, on the 25th ult., Messrs. E. & J. W. Simpson, Limited, were charged by the East and West Ardsley District Council with fraudulently extracting water from their mains. Mr. R. B. Hopkins, Clerk to the Council, prosecuted; and Mr. Lodge represented defendants. Mr. Hopkins, in opening the case, said the defendants carried on a large business; and Mr. Eli Simpson had been a member of the Council and also Chairman of the Water Committee. Up to July 13, 1896, the whole of the premises, including two cottages, were supplied through one meter. In the month named, the pipes were altered; the cottages being charged on a rental and the mill premises by meter. On Oct. 1 last, the water inspector accidentally discovered that the connection which had been cut off had been restored, and that water was passing by the domestic main to the mill without flowing through the meter. Mr. Lodge contended that defendants were perfectly innocent, and had no idea the mains had been tampered with. The full penalty of £2, with £3 15s. 6d. costs, was imposed.

Thefts from Prepayment Meters.

At Tottenham, a few days since, Henry Ruskin (13), of Enfield, and Jesse May (11), of Edmonton, schoolboys, were charged with being concerned together in stealing from No. 17, Findon Road, Edmonton, 11s. 9d. in bronze from a prepayment gas-meter, the moneys of the Tottenham and Edmonton Gas Company, and also with damaging the meter to the extent of 10s. It was shown by the evidence that the boys forced the catch of the kitchen window of the house, got in, and with a poker broke open the gas-meter and stole the money it contained. The next day they procured a ladder, and climbed into the bedroom window, ransacked a chest of drawers, took 5s. 9d. in cash and an overcoat, which they afterwards sold. Both boys bore a very bad character. The Bench ordered each to receive six strokes with the birch-rod. The aunt of May requested the Magistrates to "lay it on thick;" and this was done in the course of the afternoon.

Oil v. Gas Lighting at Aldeburgh.—For some two years Aldeburgh has only been partially lighted, and that by 27 oil-lamps; the reason being that, although members of the Paving and Lighting Committee of the Corporation were agreed to the price of £1 12s. 10d. per lamp asked by the Gas Company, the latter would not be tied to terms regarding the quality of the gas, and penalties for non-lighting, cleaning, &c. Just recently there has been an interview between members of the Corporation and the Board of the Company, and an arrangement was arrived at by which the Corporation will pay £1 7s. 6d. per lamp and do the lighting and cleaning themselves.

Gas Workers' Wages at Darlington.—An application was recently made to the Darlington Corporation Gas Committee, by Mr. H. Lynas, the Local Secretary of the Gas Workers' Union, for an advance of wages for the men employed at the gas-works. After discussion by the Committee, the Town Clerk was instructed to reply that the Gas Engineer (Mr. T. Smith) would be prepared to meet a deputation of the men to consider any application they might make, but that such application must be made by the men direct. At a meeting held yesterday week, the men decided that they would not meet the Engineer without the presence of Mr. Lynas, and that they would, if necessary, tender their notices in support of this action. The application was for an advance of 2s. per man per week for stokers, labourers, coal wheelers, &c.; and it included a request that the lamp-lighters should be relieved from yard work.

Brighouse Gas Supply.—At the last monthly meeting of the Brighouse Town Council, Alderman Sugden (Chairman of the Gas Committee) drew the attention of the members to the report of the Engineer (Mr. J. Parkinson) and the balance-sheet of the Gas Department. Those who had read the balance-sheet would have seen that there was a slight profit. Of course, this was not so satisfactory as the Committee would have liked. Brighouse would be able to make as much profit as ever if it stood alone; but they had taken over the Rastrick Gas-Works, and Rastrick had gained at the expense of the ratepayers. But there was one thing which was not altogether satisfactory. The Committee were surprised that, although the price had been lowered, the increase in consumption was not larger in Rastrick than was the case. The consumers were relatively small as compared with Brighouse. It was suggested that they should commence using penny-in-the-slot meters, which he thought would increase the consumption. More consumers were required; and then the Committee would not only supply gas at the present price, but also make a good profit. Mr. Helliwell inquired the reason why they had no report as to electric lighting. Were they making so much profit that they dare not show it to the consumers? Alderman Sugden replied that it was considered by the Committee that the report should not be published at present. Of course, they could not expect to make a profit with the plant as it was at present. The gas made during the past year was 152,803,800 cubic feet; being an increase of 6,375,300 cubic feet. The gas sold to customers was 124,450,900 cubic feet—an increase of 5,763,000 cubic feet. The works are to be improved, and fitted with an installation of inclined retorts.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY'S STOCK-CONVERSION SCHEME.

To Come into Operation, Jan. 1, 1899.

The Directors of The Gaslight and Coke Company have issued a circular intimating that, in pursuance of the powers conferred by the Company's Act of last session, the consolidation and conversion of stocks thereby sanctioned will take effect on and from the 1st prox. There are at present eleven classes of ordinary and preference stock, and four classes of debenture stock; and under the consolidation scheme they will be converted into four classes, to be designated respectively, "ordinary stock," "4 per cent. consolidated preference stock," "3½ per cent. maximum stock," and "3 per cent. consolidated debenture stock." The existing "A" ordinary stock, bearing a standard rate of dividend of 10 per cent. per annum subject to the sliding-scale, with an initial price of 3s. 9d. per 1000 cubic feet, will be converted into ordinary stock with a standard rate of dividend of 4 per cent. per annum, subject to a sliding-scale providing for the reduction or increase of such dividend by 2s. per cent. per annum for every 1d., or part thereof, charged in excess or in diminution of the above-named standard price. Each £100 of the present "A" ordinary stock will be converted into £250 of the substituted stock. Each £100 of the "A" and "F" 5 per cent. preference stocks will be converted into £125 of 4 per cent. consolidated preference stock; the "B" 4 per cent. maximum stock will remain unchanged; each £100 of the "C," "D," "E," and "J" 10 per cent. preference stocks will be converted into £250 of the above-named 4 per cent. consolidated preference stock; each similar quantity of "G" 7½ per cent. and "K" 6 per cent. preference stock, into £187 10s. and £150 respectively of the 4 per cent. stock; and each £100 of "H" 7 per cent. maximum stock, into £200 of 3½ per cent. maximum stock. Each £100 of the present 4, 4½, 4½, and 6 per cent. debenture stocks will be converted into £133 6s. 8d., £141 13s. 4d., £150, and £200 respectively of 3 per cent. consolidated debenture stock. Amounts of existing stock other than £100 will be converted into amounts of new or substituted stocks in the same ratio as that set forth above. In accordance, however, with a provision contained in section 11 of the Act, the new or substituted stocks will be issued and be transferable only in amounts of £5 or multiples thereof; and where any proprietor would be entitled to an amount of new or substituted stock which is less than £5, or which exceeds £5 or some multiple thereof by an amount which is less than £5, the Company will purchase such fractional amount of stock at the market price for the time being. Subject to the provision above referred to, the holdings of the new or substituted stocks registered in lieu of those of the existing stocks will in all cases, and under all circumstances, be such as, at the ratio of dividend or interest on the new or substituted stocks, and under the revised sliding-scale as applicable to the ordinary stock, will yield exactly the same amounts of income as would have been received by the proprietors on their holdings of the existing stocks if the conversion had not taken place.

In connection with the foregoing particulars, reference may be made to a letter, signed "Manu Forti," which appeared in the "Financial News" last Friday. Early this year, the writer called attention in the columns of the paper to the financial position of the Company, which he says has proved correct in every particular. He points out, however, that since that date various things have happened to materially improve the position; and he thinks it only right, seeing that in the letter referred to animadversions were made on the policy of the Directors, that the present position of the undertaking should be placed before the investing public. He goes on to say: "To-day the ordinary 'A' stock of the Company stands at the low figure of £280, yielding a return to the investor of £4 7s. 6d. per cent., whereas the South Metropolitan Gas Company's ordinary stock yields only £3 16s. 2d. per cent. This is paradoxical, to say the least of it; and I will endeavour to prove that it is so. The South Metropolitan Company have now got the price of gas down to 2s. 3d. per 1000 cubic feet—a figure which must be admitted very low for London, and for which every credit is due to the management. However, there is a limit to good management; and I am of opinion that in the case of the South Metropolitan Company this limit has already been reached, and it would be unreasonable to expect any further improvements under existing conditions. The Gaslight and Coke Company are now charging 3s. per 1000 cubic feet; and the indications at the present time are that this figure will be reduced, and carry with it increased dividends. The advance of 2d. per 1000 cubic feet on April 1, 1898, will increase the revenue by about £180,000 per annum. In addition to this, the market for sulphate of ammonia has improved to such an extent that sulphate may be expected to yield about £50,000 more than last year; and, taking into account the present state of trade, coke should yield a further increase of at least £50,000. These figures added together make a grand total of £280,000—a sum which should build up the lately depleted reserve fund, and place the Company on a sound financial basis. By powers recently conferred upon the Company, the 10 per cent. ordinary stock, paying 12½ per cent., will be converted on Jan. 1, 1899, into a 4 per cent. ordinary stock, paying £4 18s. per cent.; and the new issue of the converted stock—to be sold by public auction on the 6th prox.—ought to be a good investment at £122 10s. per £100. At this price it would yield 4 per cent. per annum. To make matters more clear, it may be well to point out that the ordinary stocks of both Companies are now identical. The South Metropolitan Company pay dividend on their ordinary stock at the rate of £5 6s. 8d. per cent. per annum, with the price quoted at £140 per £100—yielding £3 16s. 2d. per cent. The Gaslight and Coke Company pay dividend at the rate of £4 18s. per cent. per annum; and at the price recommended—viz., £122 10s. per £100 of stock—will yield 4 per cent. per annum, to say nothing of the prospective enhanced value of the stock."

MANCHESTER CORPORATION GAS UNDERTAKING.

Further Money Required to Meet Increasing Business.

On behalf of the Local Government Board, Mr. G. W. Willcocks held an inquiry at Manchester last Tuesday into an application by the Corporation for sanction to borrow £500,000 for the purposes of the gas undertaking. There was no opposition.

Mr. T. Hudson (the Deputy Town Clerk), in opening the proceedings, stated that the Local Act of 1875 authorized the Corporation to borrow £250,000 for gas-works. Since then, in 1880, 1884, and 1893, the Act had been amended by Provisional Orders, granting power to borrow further sums of £250,000, £200,000, and £500,000 respectively. These four amounts made a total of £1,200,000, all of which had been spent, with the exception of £20,000. It was now necessary to borrow further money for gas-works purposes; and on Oct. 26 last, the Corporation passed a resolution to apply for power to borrow £500,000.

Alderman *Gibson*, the Chairman of the Gas Committee, first gave evidence. He said that the £20,000 yet unspent would be expended entirely upon meters and stoves, probably within the next twelve months. The £500,000 authorized to be borrowed five years ago had been laid out in a manner profitable to the undertaking, and, he believed, highly satisfactory to the ratepayers, inasmuch as the price of gas had been considerably reduced, and £50,000 a year had been paid over to the city fund in aid of the rates. In 1894 there were 81,637 gas consumers; and in 1898 112,263—being an increase of about 30,000. In 1894, they carbonized 360,000 tons of coal; and in 1898, 407,000 tons. The capital expenditure on the works was: In 1894, £1,557,638; and in 1898, £1,969,333. The mortgage debt in 1894 was £653,976; and in 1898, £1,058,989. The income in 1894 was £569,032; and in 1898, £553,642, although in the meantime the price of gas had been reduced from 2s. 6d. to 2s. 3d. per 1000 cubic feet to consumers within the city, and from 3s. to 2s. 6d. to consumers outside, and meter-rents had been absolutely abolished. Had the prices been maintained at the old figures, and the meter-rents retained, the income last year would have been larger by £105,000. These figures showed that, in spite of the reductions and the competition of the electric light, the net revenue had not appreciably decreased. The £50,000 a year was still being paid into the city fund. The expenditure on revenue account in 1894 was £496,256; and in 1898, with a larger business, it was £440,845. The Corporation had every reason to believe that the number of consumers would continue to increase both within and outside the city. The population was growing, new buildings were being erected, and gas for cooking and heating purposes was becoming more appreciated. There were still some thousands of houses in the city in which there were no prepayment meters. The £500,000 would be required to meet the prospective increased demand within the next five years. The number of out-townships supplied was sixteen, with an aggregate population of 150,933. The highest daily consumption of gas recorded was 23,824,000 cubic feet. The manufacturing capacity was 22,500,000 cubic feet; and the storage accommodation equal to 25,500,000 cubic feet. The total value of the property and assets was £2,223,549; and the total liabilities £1,206,139—leaving an excess of assets of £1,017,410. The gross profit last year was £112,797. To sinking fund £56,168 was paid; leaving a net profit of £56,168, of which £50,000, as he had already said, had been paid in reduction of rates. During the last ten years, £417,762 had been paid out of the gas profits in reduction of rates; and in the same time £544,000 had been transferred to the sinking fund. A remarkable fact was that the introduction of the electric light did not seem to diminish the demand for gas.

Mr. *G. E. Stevenson*, the Gas Engineer, stated that the present manufacturing capacity was barely enough to meet the demand. The new works included the making of a complete new section of works at the Bradford Road station, large enough for the manufacture of an additional 6 million cubic feet of gas per day; but apparatus and plant would at first be laid for the production of only 3 million cubic feet. These works would absorb £200,000. At the Rochdale Road works, it was proposed to expend £15,000 upon an extension of the plant, so as to increase the output by 2 million cubic feet per day; and £5000 upon new exhausters, boilers, workshops and stores. The total expenditure at the Gaythorn station would be £30,000, with a view to increasing the output by 2 million cubic feet per day. A sum of £140,000 was estimated to be required for new mains during the five years; £100,000 for new meters and stoves; and £10,000 for new workshops, stables, and stores. Witness stated that the meters would be to a very considerable extent prepayment ones, for which there was a great future. During the last three years they had spent £70,000 on meters and stoves, the demand for which had been above expectation.

Mr. *Briggs*, the Deputy Chairman of the Gas Committee, thought it quite necessary the powers now sought should be granted. A week or ten days' fog would very severely tax the capacity of the existing works.

This closed the inquiry.

BIRMINGHAM CORPORATION GAS SUPPLY.

Report by the Gas Committee.

Among the business to be brought before the Birmingham City Council to-day is a report by the Gas Committee, in which reference is first made to the considerable progress which has been effected in the extension of the gas manufacturing and storage plant at Nechells since the Committee reported to the Council in February last. The output of gas since that time has continued to increase; and there has been nothing in the experience of the Committee since their estimates of future output were made to warrant any departure from the recommendation they then proposed for the further gradual development, as occasion may require, of the whole scheme authorized by the Council. As intimated in their report last February, the Gas Committee have authorized a further capital expenditure of £13,800 in the diversion of the main sewer across the Nechells land, and in re-forming the channel of the River Rea. The total cost of this work on the land occupied by the gas-works, including an enlargement of the sewer required by the Public Works Committee, has been estimated by that Committee at £21,000, including the cost of enlarged sewers of 7 feet and 8 feet diameter respectively, towards which the Gas Committee have agreed to contribute the sum of £13,000 on the terms already reported to the Council by the Public Works Committee. Subsequently, on the application of Messrs. Brotherton and Co., the Committee agreed to extend the work across the land leased to them. This will involve a further cost of £1000, towards which Messrs. Brotherton will contribute £200. As intimated in the report of February last, the Committee have sanctioned a further capital expenditure estimated at £11,500 in the construction of a branch railway to, and sidings on, the Nechells site. They have considered the memorial from the inhabitants of Nechells referred to them by the Council, and report that the principal portions of the extensions at Nechells being in an advanced stage, it is too late to ask the Council to reconsider their decision to extend the works on this site.

The Committee have entered into a contract with Messrs. A. W. Smith and Sons at £10,180 for the construction of walls, canal basin, &c., in connection with the extensions at Devon Street and Nechells. They have also accepted the following tenders in connection with the extensions at Nechells: Messrs. Laidlaw and Sons, exhausters and engines, £1370; Messrs. Barnsley and Son, building of new retort-house and chimneys, £13,556; Messrs. Parkinson and Co., station meter, £1935; Messrs. C. & W. Walker, purifiers, £10,985. In the absence of effective competition, and having regard to the very large advance in the price of such meters in the last few years, the Committee have ordered one station meter only for the new works instead of two, as would be necessary if a reserve is provided. While it is a matter of convenience to have a reserve station meter, it is not, as it is with some other portions of the plant, essential, as station meters are bye-passed to provide against accident.

The Committee also report on the serious explosion and fire which occurred in the large exhauster-house at the Saltley works on Nov. 13, and the Coroner's inquest on one of the workmen. They have felt that, having regard to the lamentable result of the accident, it would be the wish of the Council, without entering into the question of liability under the Workmen's Compensation Act, to assess on the lines of that Act the compensation to be offered to the dependants of the deceased workman. They have, therefore, made a grant to his legal personal representative of £237 16s. 6d. They have also awarded a sum of £25 to Mr. Morrison, the Assistant Engineer, in recognition of the great value of the services which he rendered at this difficult time, and a sum not exceeding £10 to be distributed by the Engineer among the workmen and others who gave timely and exceptional help. The Committee have given instructions that first-aid appliances shall be stored in readily accessible places in different parts of the works, and that notices shall be kept posted where these and ambulance appliances are placed.

The Committee have made the necessary contracts for coal and for gas oil for the coming year. The prices paid on these contracts will be in excess of those of the previous year. Since the contracts for coal were made, deliveries on some of the contracts for Windsor Street have been delayed, owing either to accidents at the pits or to the default of the contractors. The Committee have, therefore, purchased 7000 tons of coal for winter delivery in substitution for these arrears; and a portion of the additional price paid for this coal will be chargeable against the contractors making default. The contract with Messrs. Lewis Demuth and Co., Limited, for the tar produced at the Corporation works expired in June last, but has been renewed on revised terms for the next four years. The number of prepayment meters in use on Nov. 1 was 4800; and at that date nearly 1000 orders for such meters were unexecuted, owing to the impossibility of securing a sufficient number of gas-fitters in the winter months to execute promptly the orders for fittings work received by the department. The Committee have accepted tenders from several gas-fitters to fix these meters and fittings.

SALES OF STOCKS AND SHARES.

At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards offered for sale, by order of the Directors, £13,500 of new ordinary stock of the Southend Gas Company. It ranked for a standard dividend of 5 per cent. per annum, subject to the sliding-scale; but it was entitled, in view of the dividend paid on the existing capital on June 30 last, to an additional ¼ per cent. The stock was sold with the dividend accruing from the 1st prox. The highest price realized per £100 of stock was £115 10s.; the lowest, £111; the average, £111 10s. 11d.—yielding £4 14s. 1d. per cent. on the investment. The total amount of the sale was £15,058 15s. On the same occasion, Mr. Richards sold some new ordinary £10 shares, (7 per cent.) fully paid, in the Great Yarmouth Water Company, the last dividend on which was at the rate of 4 per cent. per annum. They fetched £12 10s. each—yielding £3 4s. per cent. on the investment. A few £10 fully paid 6 per cent. preference "A" shares realized £16 15s. each—returning the purchaser £3 11s. 8d. per cent. on his investment. Some fully paid £10 preference shares (5 per cent.) in the South-West Suburban Water Company fetched an average of £13 9s. 9d. each—yielding £3 14s. 2d. per cent.; ordinary £10 shares, bearing 4½ per cent. dividend, realizing an average of £13 16s. apiece, and returning the purchaser £3 5s. 3d. per cent. A parcel of £10 "D" water shares (£4 paid) in the Barnet District Gas and Water Company was disposed of at an average price of £7 each, and some "D" water stock at the rate of £160 per £100 of stock; yielding in the former case £3 12s. per cent., and in the latter £3 18s. 9d. per cent. There was a somewhat better demand and keener competition than has prevailed at recent sales; and the total amount realized was £21,222 17s. 6d. At a sale of miscellaneous stocks and shares at Lewes on the same day, four lots of £50 consolidated original capital stock in the Lewes Gas Company were sold at £106 each. Original £25 shares in the Lewes Water Company, earning 10 per cent. dividend, realized £80 and £82 apiece; and some £25 7 per cent. shares produced £53 and £54 each. One lot (£30) of preference stock in the same Company fetched £44. At Gainsborough on the following day, Mr. F. Baines sold by auction £4000 of new ordinary stock, ranking for a maximum dividend of 7 per cent. The prices obtained ranged from £150 to £152 10s. per cent.; and the total yield was £6047 10s. On Wednesday last, Messrs. Bishop and Pritchett submitted to public auction £5000 of new ordinary 5 per cent. stock of the New Swindon Gas Company, issued under the provisions of the Company's Special Act of 1893. Biddings were taken per £10 of stock; the prices realized being from £11 2s. 6d. to £11 14s.

ELECTRIC LIGHTING NOTES.

The Winsford District Council are among the applicants to the Board of Trade for electric lighting powers. They came to the decision to proceed in the matter on Monday last week, when estimates were submitted by the Engineer consulted, showing that a first instalment of electricity to light the principal streets could be carried out for £7700, and a complete installation for £12,000.

In a pithy letter to a Manchester paper, Mr. T. G. Jenkins, of 17, Deansgate, lays a serious complaint against the Corporation Electricity Department. He says: "Is it not time the Corporation paid some attention to the very irregular supply of electricity? The retail trade of Manchester is constantly hindered by the fluctuations. For hours our shops are in semi-darkness. Can nothing be done? My neighbours at this moment have an excellent illumination of incandescent gas, while my place illustrates the Dantesque statement 'Abandon hope.'"

Complaint was made of the erratic doings of the electric light at the meeting of the Wallasey District Council last Thursday. One member (Mr. Bleakley) asserted that the arc lamps in the streets were "generally" not alight; and Mr. Buck to some extent confirmed the statement. Mr. Lee, as a private consumer, was also disappointed with his supply, and suggested that, if the Committee had not sufficient energy, they should not profess to supply it. The Chairman of the Committee (Mr. Joyce) admitted that there was ground for grumbling by stating that he hoped they would soon have an ample supply, and that the complaint would no longer be justified.

According to the latest report, the electric light undertaking at Torquay is making satisfactory progress, and the light is now available by day as well as by night as heretofore. Since it was inaugurated eight or nine months ago, the number of private consumers has increased from forty to over a hundred. According to a local paper, "a substantial amount will be saved by the substitution of electric arc lamps for the gas-lamps." The meaning of this appears to be that in the current year's accounts the Corporation are charging themselves something less than cost price for the electricity. As a consequence, the item of street lighting in future is bound to be considerably increased.

The municipal electric lighting works at Colchester started on their career last Thursday, although the formal inauguration will not take place until next month. The engine-house at present contains three 300-horse power engines, coupled direct to dynamos of 250 amperes at 250 volts—each dynamo being capable of supplying 2000 8-candle power incandescent lamps. Ample room has been left for developing the business. The charge to consumers is to be 8d. per unit; but after a lamp has been in use 300 hours, the price is to be reduced to 5d. The cost of gas in Colchester being 3s. 3d. per 1000 cubic feet, the consumers will find electricity a somewhat more costly method of lighting.

At last Thursday's meeting of the Hampstead Vestry, the Electric Lighting Committee reported that they found the sum of £2272 which the Vestry decided to apply for permission to borrow, for the purpose of meeting the capital expenditure in carrying out the West End Lane arc lighting scheme, would be insufficient for the purpose; and, as a matter of urgency, they had instructed the Vestry Clerk to bring before the Finance Committee the question of recommending the Vestry to increase such proposed loan to £2560. This was done in its entirety. Some discussion was afterwards caused by a recommendation that further gas-lamps should be erected in certain thoroughfares; but this, too, was eventually acceded to. Mr. Richardson inquired why gas-lamps and not arc lamps were to be used. No reply was vouchsafed to the question; but the fact that the arc light outside the Vestry Hall was at the moment in a state of uncertainty spoke volumes.

There seems to have been lately quite an epidemic of failures and complaints of inefficiency of electric lighting. Even Chelmsford—the one-time show-place of an electrical firm—is dissatisfied with the way in which the Electric Lighting Company are carrying out their contract for lighting the public streets and supplying business and private establishments. Mention was made of the matter at the meeting of the Town Council last Wednesday; and it was suggested by the Lighting Committee that a strong representation should be made to the Company on the subject. Several communications had passed between the Committee and the Company as to the public lighting. On one occasion, remarked the Chairman of the Committee (Mr. E. Lawn), the Company, as an excuse, said "the damper had gone wrong;" another time it was the circuit. The Council paid over £1000 a year for the lighting of their streets; and no town the size of Chelmsford, where the electric light was used, was so badly illuminated as they had been during the last twelve months. The report was adopted. Notification was afterwards given that the Electric Lighting Company intended to lay four new cables, to act as feeders to their system, and also to construct eight new transformer pits in various parts of the borough. The Council, however, disapproved of the scheme on the ground that the plans submitted did not show sufficient details.

"There was a good deal of the bearing element requisitioned in the neighbourhood of Eastbank Street, Southport, on Saturday evening last," writes "A Groper" in the "Southport Guardian" of the 30th ult., "for at an unexpected and altogether unfortunate moment the light failed. To old consumers of course it was not altogether a new experience; they had previously had samples of its vagaries. Recognizing the claims of electricity as the capricious queen of lights, they had grown to anticipate exhibitions of regal self-assertion. But one or two new subscribers—tradesmen whose acquaintance with it is only of the nodding character—stood aghast when, without an instant's warning, the 'glim' was 'douced.' The sudden defection was not anything like general in the town. That was something for the unafflicted ones to be thankful for; but, such is the perversity of human nature, the fact only served to further aggravate the unhappy wights numbered among the roll of victims. But lamentations and recriminations were of little avail. Deep and earnest objurgation totally failed to re-kindle the vital spark enshrined within the clear globes of glass; and after a minute or so had been consumed, partly in hope that the current would resume its ordinary course, and partly in silent meditation on the mutability of human affairs—a self-communing conducted in glowing thought—the practical nature reasserted itself, and palliative agents were hastily sought."

The Corporation of Dublin were called upon last Thursday to answer two summonses in the Southern Police Court, taken out by the Sun Fire and Life Insurance Company and Mr. Wilfred Fitzgerald respectively, for having on the 21st ult. made, and continued to make, default in supplying electrical energy to their premises, thereby rendering themselves liable to a penalty of £2 in respect of every default on each day. It appeared, from the statement of Mr. Shaughnessy (representing the Corporation), that these cases were pioneer ones, and that on the issue hung a tremendous liability. He pointed out that no penalty was incurred where the default to supply the energy was due to unavoidable circumstances, as in this instance. His explanation was that a cable (which was the best known at the time it was laid, and which, it was then believed, would last for 25 years) had become defective in such a way that the electric service collapsed. But a breakdown of this kind could not be foreseen; and so, while the default was admitted, the Corporation denied wilful or negligent default. They were now laying a new cable at a cost of £100,000. Mr. Ruddle, the Electrical Engineer, supplemented this statement; he having supervised the laying of the original cable in 1891. They had discovered that, by some unaccountable reason, the rubber had perished, with the result that the energy escaped, and the supply was stopped. It was impossible to guard against this. The laying of the new cable was commenced in July; and it was guaranteed to last ten years. For the plaintiffs, Mr. Shiel contended that the want of energy was due to the breakdown of defendants' plant, which they should have guarded against. In the result, the Magistrate (Mr. Swifte) decided that the accident was an unavoidable one. Electricity, he held, was yet more or less in a tentative position; and at the time the cable was laid down, the Corporation took every possible precaution to get the best material they could. It might be a fair case to investigate; but he would dismiss the summons—giving, however, no costs.

The Walker Urban District Council have notified their intention of applying for a Provisional Order to enable them to supply electricity for lighting and other purposes; and at the meeting of the Council last Tuesday the Special Electric Lighting Committee reported that plans had been prepared and also a memorial, and it was recommended that this should be signed. It was further reported that the Walker and Wallsend Gas Company intended to apply to Parliament for a Bill giving them power to supply electricity in the district. On this subject the Clerk (Mr. T. M. Sturgess) read a communication from the Company, enclosing the copy of a letter containing terms which had been offered by them to the Wallsend Council, and had been accepted as a basis of negotiations in reference to the Company's proposed application to Parliament for electrical powers, and asking if the Walker Council would enter into a similar arrangement, with a view to coming to an amicable understanding which would largely diminish the otherwise very heavy expense which might be incurred before the Parliamentary Committee. The terms offered to the Wallsend Council were: (1) That the Company would not at any time after the passing of the Act oppose or raise any obstacle to the Council, or their successors, applying for and obtaining powers under the Electric Lighting Acts, 1882 and 1888. (2) That the Company, so long as they generated electric power, and so long as the Council did not themselves supply electricity, would supply electrical power to the Council and their successors, and to any company or persons within their district, at as cheap a rate as was *bonâ fide* offered or supplied by any corporation or public company within the area of the district under statutory authority. (3) That the capital account of the electric undertaking should be kept separate from the gas undertaking. (4) That the revenue accounts, giving the gross profit relating to both electricity and gas, be combined in one common profit and loss account. (5) After paying statutory dividend and other obligations, the surplus profit, if any, to be applied to the reduction of the price as provided by the action of the sliding-scale. The Clerk submitted these terms to the Parliamentary Agents of the Council, who, after dealing with the various offers, said they did not see anything in them which would make it advantageous to the ratepayers of Wallsend to allow the Company to obtain electrical powers in lieu of the Council. The part of the report having reference to the signing of the memorial was then adopted; the question of the offer from the Company, and the reply that should be made to it, being left over for future consideration.

Additional Stoking Machinery for the South Metropolitan Gas Company.—The South Metropolitan Gas Company, having recently decided to increase their installations of mechanical stoking machinery, have placed orders with Sir William Arrol and Co. for two charging and two drawing machines of the Arrol-Foulis type for their works at East Greenwich, and also for the same number of machines for their Rotherhithe station. At East Greenwich this system of stoking has been in use for some few years; it being, indeed, the first station in London where this class of machinery was adopted. At Rotherhithe a very complete Arrol-Foulis plant has now been working for two years; and it is satisfactory to notice that the Company propose to still further employ the system at both of these works.

The Water Supply of St. Agnes.—The difficulty of providing an adequate supply of water in some of the scattered and thinly populated parts of Cornwall was shown at an inquiry recently held by Mr. H. P. Boulnois, one of the Local Government Board Inspectors, respecting an application by the Truro Rural District Council for a loan of £5000 for the provision of water-works at St. Agnes. The parish has a population of 4249, an area of 5419 acres, and a rateable value of only £6311. In it there are a number of scattered hamlets. To provide water for the more important of these, Mr. R. H. Worth, the Engineer, said it was necessary to take three levels of supply. One would be served from a water-tower; the second from a reservoir with a special service reservoir for a little district of 300 inhabitants; and the low level would have a separate gravitation supply. The total population served by these works will be 1900; and the quantity will be equal to 16 gallons per head per day. At present it is not more than 3 gallons. Opposition was offered by the ratepayers in those parts of the parish which do not come into the scheme. Mr. A. Strauss, M.P., attended the inquiry, and pointed out the hardship which would be inflicted upon the district if repayment of the loan should be required in the customary period of thirty years. At present, the rates are 5s. 6d. in the pound; and if repayment has to be made in 30 years, a rate of 2s. 6d. would have to be levied every year for the purposes of the water-works. The burden would be a very heavy one for a district which is already impoverished through the depression in Cornish mining. The Inspector promised to lay the views of Mr. Strauss before the Local Government Board.

METROPOLITAN WATER SUPPLY COMMISSION.

Thirty-seventh Day—Monday, Nov. 28.

(*Viscount* LLANDAFF, *Chairman*, *Sir* JOHN E. DORINGTON, Bart., M.P., *Sir* G. B. BRUCE, M.Inst.C.E., *Major-Gen.* A. DE COURCY SCOTT, R.E., *Rt. Hon.* J. W. MELLOR, Q.C., M.P., *Mr.* A. DE BOCK PORTER, C.B., *and Mr.* R. LEWIS.)

The Commission sat at the Guildhall, Westminster.

The following are the Counsel engaged: Mr. POPE, Q.C., and Mr. CLAUDE BAGGALLAY, Q.C., for the New River and the Southwark and Vauxhall Companies; Mr. LITTLER, Q.C., and Mr. LEWIS COWARD for the Kent Water Company; Mr. PEMBER, Q.C., for the Lambeth, East London, Grand Junction, and West Middlesex Water Companies; Mr. RICKARDS for the Chelsea Water Company; Lord ROBERT CECIL for the Hertfordshire County Council; Sir JOSEPH LEESE, Q.C., M.P., for the Kent County Council and Kent Local Authorities; Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN, Q.C., for the London County Council; Sir R. NICHOLSON for the Middlesex County Council; and Mr. GABRIEL P. GOLDNEY (Remembrancer) for the Corporation of the City of London.

Mr. *R. E. Middleton* was further examined by the CHAIRMAN, with reference to a table which he put in, showing his estimate of the cost of supplying 185½ million gallons per day from the Thames on the basis of the circumstances of 1898. This table was intended to compare with a similar one put in by Sir Alexander Binnie. The total storage required was 13,719 million gallons, or, allowing 1247 million gallons for bottom water and evaporation, and nothing for cleaning, 12,472 million gallons. Deducting the existing storage capacity of 866 million gallons, left a total capacity of 12,853 million gallons to be provided, which, at £204 3s. per million gallons, equalled £2,625,868. The cost of pumping into reservoirs 4961 million gallons, the average for sixteen years, at 7s. 6d. per million gallons, was £1860 7s., or, for sixteen years, £29,765. The cost of pumping to supply a quantity increasing from *nil* to 55½ million gallons per day during sixteen years, at £2 4s. per million gallons, would be £320,178. These three figures of £2,625,868, £29,765, and £320,178, totalled £2,975,811, or, *plus* £181,980 for pumping machinery necessary for distribution, would make £3,157,791. If the pumping charges were capitalized at 3 per cent., and reduced to present value, a sum of £1,296,837 should be substituted, increasing the total to £4,104,685. This table compared with one put in by Sir A. Binnie, in which he took the total storage capacity at 8000 million gallons, and brought out the total cost at £4,705,185. Witness's table and the one put in at the last sitting were based on the assumption that they would be able to pump into the reservoirs average quantities of water indicated by sixteen years' gaugings of the Thames. If a year like 1893 recurred, they would have to pump a little more than the average of the sixteen years—perhaps, 500 million gallons. Witness put in another table, being his estimate of the cost of supplying 300 million gallons daily from the Thames under the conditions of the river in the year 1893. The total storage required would be 21,725 million gallons, or allowing 1975 million gallons for bottom water and evaporation, and nothing for cleaning, a net storage of 19,750 million gallons. Deducting the existing capacity of 866 million gallons, left 20,859 million gallons to be provided, which, at £212 per million gallons, worked out to £4,422,108. The cost of pumping 7764 million gallons, the average for 35 years, at 7s. 6d. per million, equalled £2911 10s., which, for 35 years, would be £101,902. The cost of pumping to supply a quantity increasing from *nil* to 170 million gallons per day, during 35 years, at £2 4s. per million gallons, equalled £2,173,794. These three figures totalled £6,697,804, or, *plus* £557,460 in respect of pumping machinery for distribution, £7,255,264. A sum of about £1,155,000 should be added to this estimate, for connecting mains to the boundaries of the Companies' districts, to compare with the item of £3,000,000 for connecting mains between the service reservoirs at Elstree and those of the Companies in the Welsh scheme, which would increase the figure to £8,410,264. This table also was intended to compare with a similar one by Sir A. Binnie, in which he took the total storage required at 28,000 million gallons, and brought out the cost at £15,589,990. The 35 years referred to were those from 1901 to 1935, and were based on the experience of the past. Witness also put in another table showing his estimate of the cost of supplying 300 million gallons daily from the Thames under the conditions of 1898; the total storage required being 30,468 million gallons, and the cost £9,773,029 (which would include the £1,155,000 as in the previous table). If the pumping charges were capitalized at 3 per cent. and reduced to present value, a sum approximating to £2,908,671 should be substituted for these two items—making the total £10,399,441.

Mr. POPE, in reply to Mr. LEWIS, stated that the interest on the debenture stock of the Staines Reservoirs Committee was paid by contributions from the three Companies, so that to the extent of their contributions their revenue was decreased.

Witness (continuing) said his items for pumping into reservoirs and pumping for supply would only increase as the demands increased; and therefore they were a directly remunerative charge. Consequently, he did not think they should be charged against capital account, though he had included them in his tables. He went on to point out that the effect of the Companies not being allowed to take more than their appointed quantity every 24 hours, was that on a number of occasions they did not get their quantity. This seemed unfair; and he suggested that the average should be spread over a longer period—say, six months. Witness handed in several further tables containing calculations as to future requirements, amounts procurable from the Thames, &c.

The CHAIRMAN: The only inference I can draw from these tables is that the 300 million gallons from the Thames will be sufficient for the supply to Water London to the year 1940.

Witness: Yes.

And that the 400 million gallons is sufficient for the supply to 1953?—That is so.

Further tables were then handed in by witness showing that a much smaller quantity of storage would be required to procure supplies from the Thames, if the minimum flow at Teddington were reduced from 200 to 150 million gallons daily.

The CHAIRMAN: Now, with regard to Wales. Your general opinion is that to get the supply from Wales will be more costly than to obtain a supply from the Thames?

Witness: Yes.

But it is your opinion that it may be ultimately required?—I do not think we need consider it. In a future generation it might be necessary, but not within the next fifty years.

Mr. DE BOCK PORTER: But if it is necessary to go to Wales at all, is it not desirable to go there while an area can be secured?

Witness: I think it is more reasonable to use up supplies at home than to go to Wales and come back to the Thames afterwards.

Mr. MELLOR: Do you not think it desirable to secure this area, for fear it should be taken?

Witness: I think it quite possible that it might be desirable to do so.

The CHAIRMAN: One does not quite see why London has a right to peg down a claim in Wales?

Witness: I do not think it has.

Mr. MELLOR: But London is only competing with other cities.

The CHAIRMAN: There are not an unlimited number of mountains in the British Islands?

Witness: There are not.

Mr. PEMBER: I think Parliament has been very careless about allowing people to get hold of large drainage areas.

By Major-General SCOTT: There was no doubt that 400 million gallons could be obtained from the Thames as easily as 300 million gallons—still leaving an abundance of water in the river.

By the CHAIRMAN: It became therefore a question whether it was cheaper to get good and pure water from Wales, which could be supplied by gravitation, or to obtain this additional water from the Thames, which would have to be pumped and filtered. The Welsh water also, he thought, would have to be filtered. The existing sources of supply, as defined by the Balfour Commission, were: From the Thames, at least 300 million gallons; from the Lea, 52½ million gallons; from wells in the Lea Valley, 40 million gallons; and from wells in the Kent Company's district, 27½ million gallons—a total of 420 million gallons. Without departing from the ruling of that Commission, he thought the following quantities could be obtained: From the Thames, at least 400 million gallons; from the Lea, 52½ million gallons; from wells in the Lea Valley, 40 million gallons; from wells in the Kent Company's district, 27½ million gallons; from the Southwark and Vauxhall well, 2 million gallons; and from other wells in Kent, at least 123 million gallons—a total, as a minimum, of 645 million gallons. Beyond this in his opinion, could be added, from wells sunk in the chalk basin of the Thames, at least 190 million gallons—making a grand total of 835 million gallons. The 400 million gallons from the Thames would be on the condition that 200 million gallons flowed daily over Teddington Weir. There were days this year when the supply was not sufficient to have enabled the 400 million gallons to be taken from the Thames; but on these occasions the quantity would have been made up out of storage. The 123 million gallons from Kent would diminish by the amount of water flowing into the tidal portion of the Thames. The 190 million from chalk wells in the Thames Valley was based on the yield in the Lea Valley. Turning to the Welsh scheme, he said that, in comparing the cost of this supply with a further supply from the Thames, he ignored works in connection with the obtaining of 185½ million gallons from the Thames, because the works would have to be carried out whoever owned the Companies. The geological position of the Welsh source of supply was not as good as others he had seen. The lengths of banks for impounding the water could not be accurately estimated, because the sides of the valleys were covered with drift, the extent of which was unknown, though a railway cutting showed it to a depth of 20 feet. Some of the stone was too soft, and some too hard, for making a dam; so that stone for this purpose would have to be brought from a distance, or worked at considerable cost. The area of land required for the Welsh scheme, he had heard, would be 488 square miles.

Sir G. BRUCE: In the Thames you get a watershed without paying for it.

Witness: Yes.

By the CHAIRMAN: Fifty-two and a half million gallons was a little less than half the daily flow of the Lea; being 86 per cent. of the smallest flow, excepting this year. The 52½ million gallons, with proper storage, could easily be obtained—still leaving plenty for navigation purposes. The 400 million gallons from the Thames represented 44 per cent. of the available water. Therefore the river was not drawn upon to the full extent it might be. The flow of the Thames could safely be reduced below 200 million gallons at Teddington. The flow of this quantity would have little effect in scouring. At least 1000 million gallons would be required to have any effect in this way. He went on to suggest that the Companies should come to a general agreement with the Thames Conservancy with regard to the drawing of water from the river, under which there should be a gauging station at Teddington, with a limit fixed below which it should not be right for the Companies to pump from the Thames; that the payment to the Conservancy for cleansing the river should be fixed on some calculable basis; that the water drawn should be managed by a Joint Board, constituted as the Companies or Parliament might decide—possibly like the Staines Reservoirs Committee—who should determine how the water was to be allotted to the Companies from year to year, and how distributed. Thus further powers to the various Companies would only be granted as the Board should determine. It would mean practically an amalgamation for the purposes of procuring more water, but not for purposes of dividend or charges. This suggestion expressed simply his own view—not that of the Companies. He expected deposits from the mountains would be swept down into the Welsh reservoirs, and tend to fill up the unevennesses at the bottom. With regard to the Thames, he thought there was no danger of taking flood water at any time. The first few days of a flood brought down more agricultural refuse and sewage than the later days; but this could be corrected by passing the water, if impounded, a little more slowly through the filter-beds. Experience showed that in a short time 80 per cent. of the bacteria subsided—he presumed they died, since they did not re-appear. He agreed that if flood water were put directly on the filter-beds there would be more bacteria. The flow of the Thames this year proved effectually, he thought, that the limit of flow at Teddington might be considerably reduced, because it had been to a lower limit—by 100 million gallons—than in any other year; and there had been no injurious effect.

Thirty-eighth Day.—Tuesday, Nov. 29.

All the Commissioners were present except Sir John Dorington and Mr. Cripps.

Mr. *Middleton*, re-called, said he thought that in a season when the Thames was likely to fail, the Companies were much more likely to fail; also that the water proposed to be drawn from the Thames was far less in proportion than that which it was proposed to draw under the Welsh scheme. The rainfall was very much greater in Wales than in the Thames area—viz., 54 to 60 inches, against 28 inches. He had gone into the question of the income that was likely to result from the increase of supply from the complete Staines scheme, and was of opinion that no reliable calculation could be made. He was, however, certain that the increase would remunerate the Companies for the expenditure on the Staines scheme, and leave a large sum to spare—that was, assuming the present rate of expansion to continue. Before it was necessary to go to Wales for a supply, London would have become such a city as no one had ever heard of; there being enough water in the Thames for a population of 18 million people. The advantages of the Staines scheme were that the reservoirs could be constructed one at a time as required, and that they would become remunerative shortly after the commencement of their construction. Each reservoir would cost about £800,000, be of 3600 million gallons capacity, and afford a supply to begin with of 40 million gallons daily, decreasing to some 20 million gallons as the total supply from the whole of the reservoirs approached 400 million gallons daily. Each reservoir would furnish a less supply as the number of the reservoirs increased. The great drawback to the scheme was that the water would have to be pumped. The advantages of the Welsh scheme were that the water would come from practically uncultivated land, that it would be soft, and that it could be supplied to the greater part of London by gravitation. As to the softness, while it was of benefit for some manufacturing purposes, it was doubtful if, generally speaking, it was a dietetic advantage. Against these advantages, he held the scheme to be more costly, and that the expenditure on it would be unremunerative for a longer time, than in the case of the Staines scheme. Further, there was some danger in relying upon an aqueduct from 150 to 176 miles long for so large a proportion of the supply of the Metropolis. Ultimately there would be two aqueducts. There would also be difficulty in connecting the supply mains from the Elstree reservoirs to the existing service reservoirs of the Companies, and in the fact that the localities traversed might claim part of the water being supplied. He had prepared an estimate of the cost of the Welsh scheme by analogy with the cost of the Manchester, Liverpool, and Birmingham supplies, the three aqueducts in connection with which averaged 81 miles. On this basis, he calculated the cost of the head works, including dam, land, compensation, and 81 miles of conduit, at the average rate of £91,611 per million gallons of supply; and he adopted this figure in his Welsh estimates. The length of the aqueduct from Wales would be 162 miles; so that there remained 81 miles of aqueduct, capable of delivering 215 million gallons a day, to be provided. He had worked out a section of an aqueduct of this description, and found it would cost £64,000 a mile; and he estimated the cost of the second 81 miles on this basis. Nothing was allowed in the £64,000 for connections with the service reservoirs of the Companies.

By Major-General Scott: The conduit which would be first constructed would be for the whole 215 million gallons, though the first instalment would only be for 125 million gallons. Witness handed in tables giving the cost of bringing 123½ million gallons daily from Wales to London, calculated by analogy from the cost of the Thirlmere, Vyrnwy, and Elan Valley works. The reservoir would be the Yrfon. The cost of storage for the delivery of 123½ million gallons daily, and for 81 miles of pipe-line and conduit, at an average cost of £91,611 per million gallons of daily supply, would be £11,313,958. To this he added for an average of 81 miles of conduit (beyond that in the Thirlmere, Vyrnwy, and Elan Valley schemes) to convey 215 million gallons daily, at £64,000 per mile, £5,184,000; for service reservoirs at Elstree, £1,314,750; for mains between service reservoirs at Elstree and the service reservoirs of the Companies, £3,000,000; and for cost of pumping machinery to supply 30 million gallons daily, £98,280. These sums totalled £20,910,988, which was his estimate of the capital cost. To this amount he also added the cost of pumping to supply during twenty years a quantity increasing from 21·7 to 29·8 million gallons, at 30s. per million gallons pumped, £279,549; for works in progress, £7,296,098; and for accumulated interest, £13,916,861. In reduction of the total of these figures—£42,403,496—he credited £352,411, the cost of pumping that would be saved. The latter item in this and the other tables of further supplies from Wales, was calculated on the whole of the expenses at present incurred per million gallons pumped. This was, however, an exaggerated view of the case, as the engines must stand ready at all times for pumping in case of necessity. Therefore a certain proportion of the charges for wages, coals, and maintenance must continue; and the saving would be reduced to this extent. Without allowance for further expenditure on works, the estimate would stand: Capital expenditure, £20,910,988, which, less £72,862, cost of pumping saved, became £20,838,126. This sum, *plus* £13,078,046 accumulated interest, would bring the total to £33,916,172. By work in progress, he meant the work on succeeding reservoirs which would have to be commenced a long period before the first well was completed. Witness put in another similar table showing the cost of bringing 135 million gallons daily to London— the two reservoirs being the Yrfon and Towy—which table was calculated in the same way as the preceding one. The only new item was an addition of £360,000 for 18 miles of pipe to connect the Towy with the Yrfon reservoir. The total capital cost he brought out at £22,327,800; and the final figure (including cost of pumping, and sums for works in progress and accumulated interest, and crediting the cost of pumping saved), at £45,801,037. Without allowance for further expenditure on works, the final figure would be £36,793,176. A third table showed the cost of bringing 172 million gallons from Wales to London (the Ithon reservoir being added in this case); the extra item in this estimate being £480,000, the cost of connecting the Ithon and Yrfon aqueducts by a pipe 16 miles long, at £30,000 a mile. The total capital cost was £27,803,467; and the final figure, arrived at in like manner to the preceding cases, £52,715,831. Without allowance for further expenditure on works, the estimate would be £46,964,367. Another table gave the estimated cost of bringing 215 million gallons from Wales to London; the fourth reservoir being the Wye. The total capital cost he calculated at £32,799,310; and the final figure, at £57,262,678. In this table, there was no addition for works in progress. A sum of £250,000 was allowed for the connection between the Upper Wye reservoir and main aqueduct—12½ miles of pipe, at £20,000 a mile. Roughly speaking, in the first three cases he practically doubled the cost of the undertaking by works in progress and accumulated interest. In all his calculations, both as to the Welsh and Thames schemes, he had included nothing for connections with the service mains of the Companies. The capital cost of the works in Wales to produce the 123 million gallons daily he made to be five times his estimate of the cost of the Staines scheme.

By Mr. Mellor: The water from Wales would require a good deal of filtration, because it contained a large proportion of peat, and peat needed more filtration than almost anything.

Sir G. Bruce: How many more of these Staines reservoirs of 3600 million gallons would you require under the conditions of 1898, than under those of 1893?

Witness: As nearly as I can tell, two.

The Chairman: I suppose the result of all these tables is that, in your view at least, the carrying out of the Welsh scheme would mean a financial deficit?

Witness: That is my opinion.

The deficit must be made good either from the consumer or from the ratepayer?—Yes.

And if the whole matter is in the hands of the London County Council, and they supply to outside counties in bulk, I suppose it is fair to assume they will have to bear a proportion of the expense?—Undoubtedly.

And the London consumer himself would have to pay more or be aided by the ratepayer?—Yes.

Have you any opinion about the claim that the different counties have made to the supplies of water that exist in their own districts?—It seems to me to be unjustifiable in every way. I do not see how any county can claim that. It merely passes through the county.

For instance, that the water in the Kent chalk does not primarily belong to the county of Kent?—Primarily, no. It is in exactly the same position as a river; it is passing through to the Thames. If they can intercept it, I presume they have a right to do so—so has anybody else. Perhaps, however, something is to be said for the counties being allowed to supply themselves first.

Further examined: The Companies, if left to themselves, would not touch the Welsh scheme in the next century; but they might do so in the century after the next. He did not consider the regulations of the London Water Companies were up to the latest standard—the standard in force (say) in Newcastle. The depth at which a main was laid had not necessarily any bearing on its becoming frozen and bursting. The soil and the pressure of the water had more to do with it. Undoubtedly, however, the risk would be reduced by laying the mains deeper.

At the conclusion of witness's examination in chief, he was subjected to a long cross-examination by Lord R. Cecil, who stated that the position of the county of Hertford was that, as long as London took water without diminishing the streams, springs, and wells of the county, Hertford would not object; but that they would have a grievance as soon as these were diminished. Witness said he certainly held that more water could be pumped from the Herts chalk than was taken at present. As Sub-Commissioner to the Balfour Commission, he made an experiment on the Amwell spring by pumping for seven hours. The spring was considerably lowered; but further pumping would not have reduced the level more, because the lowest point was reached at the end of 2½ hours. The reason it was not reduced further was that the water flowed in too quickly. He agreed that there was nothing to show that if they had continued pumping for 24 hours with full strength, they would not have continued to reduce the level, except the fact that they did not do so. So much of the water of the Lea as came from chalk in the Lea Valley was in hydraulic connection with the water in the chalk. The water which the New River Company pumped from their chalk wells was in hydraulic connection with the great body of the chalk; and the springs of Hertford were also in connection with the great body of water contained in the chalk. It did not hurt the streams to pump from wells, though there was hydraulic connection.

By Major-General Scott: If a well were made and pumping started, the water would not sink round it further than the cone of depression.

Lord R. Cecil put it to witness that if they lowered the level of the water in the chalk, they would eventually destroy the streams; but witness held that pumping would not lower the water beyond the cone of depression. There could be no flow of the water under London towards the sea, because it was all being taken out by private pumping—to the extent probably of 10 million gallons a day. The abstraction of this quantity was sufficient to cause a permanent depression under London.

The Commission adjourned.

The thirty-ninth sitting of the Commission was held yesterday, at the Guildhall, Westminster—Viscount Llandaff presiding, and all the Commissioners being present except Mr. Cripps. Mr. Reginald Middleton, whose cross-examination by Lord Robert Cecil, on behalf of the Hertfordshire County Council, was concluded at the preceding sitting, now attended to undergo cross-examination by Mr. Balfour Browne for the London County Council. In reply to the learned Counsel, witness agreed that, as regards construction of water-works, conduits, large reservoirs, masonry dams such as that which the Council contemplated making on the Upper Wye, &c., he had not had so much experience as Sir Alexander Binnie, Sir Benjamin Baker, and Mr. Deacon. He was further questioned with a view to showing that the basis of his calculations—viz., 35 gallons per head per day—was below what the consumption actually is now, and below what it would be in the future.

Llanrwst and District Water Supply.—A meeting of the Urban and Parish Councils of Llanrwst and Trefriw was held at the first-named place last Wednesday, when plans prepared by Mr. P. M'Intyre for supplying the district with additional water from the Crafnant Lake, at a cost of about £1400, were provisionally approved.

LORD ONSLOW ON THE METROPOLITAN WATER QUESTION.

At the Junior Constitutional Club last Thursday evening, Lord Onslow addressed the members on the subject of the water supply of London. He began by tracing the history of the question in its comparatively recent phases, and said he was as anxious as anybody that the undertakings of the Water Companies should be acquired for the lowest sum possible. But he did not think any man in London desired to see the unfortunate investors—many of them as poor as the poorest owner of property—deprived of their possession unjustly; and he was sure Parliament would never sanction it. He grieved very much to say that many of his friends on the County Council whom he thought were stalwarts in the interests of the burdens to be placed on the ratepayers, had been alarmed by the state of affairs in East London, and had given their consent to the introduction of the Bills for next session, containing, as they did, what he thought a most unjust arbitration clause. He called that legislating in a panic. They had done this without waiting for the report of the Royal Commission; but he believed Parliament would insist upon having that report before they gave their vote on the second reading. He scouted the idea that the necessity for such legislation was urgent because of the danger of a water famine; and in support of this view he quoted the figures lately published in "The Times" showing that London had the greatest supply per head of any large town in England. He said the fact was the water famine cry was a gross exaggeration. How were they going to settle the water question? He was one of those who thought it could only be settled in one way, and that was by the acquisition by a public authority of the undertakings of the Companies. The question, of course, was: What was the cost to be? He had gone through all the estimates; and, while they varied a great deal, they were all very high. The late Mr. Smith was prepared eighteen years ago to give between 30 and 33 millions; Mr. Harrison said it would be a sum approaching 50 millions; Lord Farrer, that it would be between 36 and 40 millions; while the Stock Exchange value was about 39 millions. Supposing they took an intermediate figure, and called it 35 millions, the annual charge, after providing for sinking fund, would be £1,167,000. The present income of the Water Companies was £990,000. It was possible there might be some saving in the charges for management; but if there were, it would be far more than obliterated by the fact that the rates charged in various parts of London were so totally different, that it would be obligatory on any public authority to bring down the rate to the lowest which was now paid. Then they must add the 16½ millions which it was proposed to expend as a first instalment in bringing water from Wales. Therefore, adding this, he made out that the annual charge would be £1,717,000; so that the loss between the amount received from the rates and the charge London would have to pay would be £727,000. This was equal to a rate of 4½d. in the pound through the whole of London. He thought the first and most important thing to be done was to compel the Companies who had a sufficiency of water to supply those which suffered from a dearth. This ought not to be delayed a day or an hour. It was admitted that the total quantity of water was adequate to all the requirements of the Metropolis; and it only wanted an equitable and proper distribution. The Bill proposed to be introduced by the London County Council did not provide for this at all, and, therefore, there was nothing to prevent the people of East London from being again brought face to face with a water scarcity such as they had had this year; and they would only have the County Council to blame for not having taken the steps which it was perfectly within their competence to take if they had chosen to do so. He believed the Companies and the Government would remedy this mistake. As regards the administering authority when the Companies were purchased, he did not think it was wise to entrust the administration of one of the first necessaries of life to a body who were swayed entirely by political considerations. He was an advocate of purchase upon fair and reasonable terms. He did not mean terms which should be fair and reasonable only to the Council or the purchasing authority, but to the sellers as well as the purchasers. His belief was that an equitable solution of this great controversy would be found by the intervention of the Government. A short discussion followed the address.

WELSH VIEWS ON THE LONDON COUNTY COUNCIL'S WATER SCHEME.

We learn from the "South Wales Daily News" that public men in South Wales are closely watching events in connection with the London County Council's endeavour to make a wholesale appropriation of water areas in Wales; and there is a general agreement that steps should be taken by the summoning of a conference representing various authorities in the counties affected, to devise means for protecting local interests. There is no disposition to prevent London from securing a supply of water from Wales; but, on the contrary, both a recognition of the need of the Metropolis and a willingness to further any project that does not injure local communities. It is deemed to be quite practicable for both South Wales and London to be served fully. But if the latter obtains exclusive powers of appropriation, the welfare of the former may be seriously jeopardized; and the present is considered to be the time to take precaution against any such eventuality. The Monmouthshire County Council have always kept a keen eye upon any project of water "grabbing," either by the London County Council or any other body. For example, in regard to the Birmingham scheme, they co-operated with other authorities and with landowners in the areas interested to obtain clauses giving compensation water. In regard to the London attempts, the Parliamentary Committee of the Council as long ago as 1895 instructed their Clerk (Mr. Gustard) to consult with the Council's Parliamentary Agents in order that they might be informed as to any fresh phase arising in connection with the project. At that time there was talk of joint action with the Glamorganshire Council; and but for the fact that no definite scheme was propounded, no doubt such concerted action would have been decided on. Later, the aims of the London promoters seemed to be concentrated specially on the Usk and the Llangorse Lake area. Monmouthshire interests were consequently more vitally affected; and it was then determined, in order to more effectually assert the proper rights of the county, to act independently in opposing any scheme. The opinion has been expressed that the Monmouthshire Council would not rest contented until they had obtained the insertion of a clause giving compensation water for any abstraction from the Wye. This river, so far, was the only one affected; but other adjacent authorities were interested in the same stream, and no doubt would assist in the opposition to gain this end. The present avoidance of the Llangorse area was probably due to the fact that the populous districts of South Wales would ultimately need a supply from that source themselves. Alderman P. Wilson Raffan, a member of the Parliamentary Committee of the Monmouthshire Council, has expressed his willingness to cordially co-operate in any movement to retain areas really required to ensure a full and continuous supply of water to Wales. The claims of Wales in the matter should, he thinks, be absolutely paramount. At the same time, he deprecates any "dog-in-the-manger" policy. London urgently needs fresh sources of supply; and to oppose the policy of the Progressives with a mere sentimental cry of "Welsh water for Wales" would, in his opinion, be not only selfish, but criminal. He cordially approves of the proposal to hold a conference of Local Authorities—including County Councils, District Councils, and Parish Councils; and hopes that compromise is not impossible on lines which will safeguard the interests both of Wales and London. If, however, London scouts reasonable restrictions and reservations, there will be no course left but a determined fight on behalf of Welsh rights. With reference to the effect of the proposals of the London County Council on the Swansea district, Mr. R. H. Wyrill, the Water Engineer to the Swansea Corporation, says they would not have any effect at all on that borough. The Chairman of the Merthyr District Council (Mr. V. A. Wills, J.P.) is of opinion that if London is allowed to take the watersheds, as proposed, it should be upon the distinct understanding that, should any towns in Wales hereafter require water from any of those sources, they would be able, as a matter of prior right, to obtain a supply. The present scheme, without these conditions, would be objectionable; and he thinks a joint conference, representing the combined interests of the different authorities, should be convened to devise means for watching all their interests, and to resist any further attempt to deprive the Principality of its water. The Manager of the Pontypridd Water-Works (Mr. W. Jones) also favours a conference. He says it is a matter of vital importance to take joint action to oppose the diversion of Welsh water to English centres until Wales first has an efficient supply for present and future purposes. He regards this as "a matter of life and death to Glamorganshire;" and he considers there is no time to be lost. The Chairman of the Pontypridd Council (Mr. P. Gowan) agrees that a conference should be held. The Medical Officer of Health for the district (Dr. Howard Davies) is of opinion that the Bill of the London County Council should be strongly opposed. As all the available sources of water are already utilized, he considers it is of vital importance that the catchment areas in Breconshire and elsewhere should be conserved for the future. Mr. D. M. Jenkins, the Neath Borough Engineer, is of opinion that a conference is really necessary to enable the authorities charged with the duty of guarding the interests of the public to fully investigate the matter, and so arrive at a clear understanding of what the proposals of the London County Council really mean. He would like the conference, after discussing the London water scheme, to give attention to the general question of the water supplies of the country, with a view to having water areas allocated. He quite agrees with the convening of a conference, and thinks such a gathering of representative men would at the least succeed in showing that, upon the report of the Royal Commission of 1893, the London County Council are premature with their proposals.

ARBITRATION UNDER THE STAINES RESERVOIRS ACT.

(*Before Mr.* A. R. Stenning.)

As one consequence of the parliamentary authorization obtained for the Staines Reservoirs scheme, Mr. A. R. Stenning was engaged as Umpire on Wednesday, the 23rd ult., and following days, in considering the claim of Mr. George Gregory, a Parliamentary Agent and Solicitor, of the Sanctuary, Westminster, against the Staines Reservoirs Joint Committee for compensation; the amount being £6251.

Mr. Freeman, Q.C., appeared for the claimant; Mr. Claude Baggallay, Q.C., and Mr. Lewis Coward, for the Joint Committee.

Mr. Freeman, in his opening statement, said Mr. Gregory was the owner of a riverside estate known as Rivernook, in the parish of Wraysbury; and the claim was in respect of certain of his lands which have been taken for the purposes of the Joint Committee, and for compensation for damage to the rest of his estate. Counsel reminded the Umpire that the Committee's scheme was for the purpose of taking water from the Thames just above Bell Weir Lock. From this lock, which was a few yards from Mr. Gregory's property, it was intended to carry the water right across his park by a covered aqueduct, syphon it under the River Colne, and then carry it on in an open aqueduct across the claimant's meadows, passing under the high road from Staines to Wraysbury and Windsor, and proceeding across other lands to the reservoirs. Part of the property affected was acquired by Mr. Gregory in 1886; and subsequently he purchased a freehold cottage with about 6 acres of land attached. This was the land through which the covered aqueduct would have to run. Counsel proceeded to describe in detail the measures taken by Mr. Gregory to convert the land he had acquired into a valuable property, and also the steps he had taken to improve the Colne as a fishing stream, by turning into it a number of trout; and he complained that his fishing, both in this stream and in the mill-tail at Hythe End Mill, would be seriously interfered with by the proposed works. For this and other interference with the amenities of the estate, compensation was claimed in addition to the value of the lands taken. Counsel pointed out that the estate was not one which had been acquired as it now stood, but represented a considerable amount of labour, expense, and personal supervision; and its value was obviously as a riverside residence which was only 18 miles from Hyde Park Corner. Mr. Gregory had opposed the Committee's Bill of last session; but he withdrew his opposition on clauses being inserted for his protection.

Mr. *G. Gregory* was then called, and bore out the opening statement of Counsel. He said that, including the purchase price, he had spent

upwards of £15,000 on the property. He thought the three Water Companies concerned—the Grand Junction, New River, and West Middlesex—were taking a very much greater width of his land than was necessary for their reservoirs.

Mr. BAGGALLAY said a 12-foot bridge should be placed where Mr. Gregory wished to connect two severed portions of his property, and he and his successors in title should have the exclusive right of fishing in the mill-tail from the land which the Joint Committee proposed to acquire. The Companies would also undertake to bring in water on both sides of the aqueduct for the purpose of watering the cattle.

Mr. FREEMAN asked whether the Companies would engage to limit the take from the Colne when the water was low even if 265 million gallons were flowing over Bell Weir.

Mr. BAGGALLAY refused to give such an undertaking. He said the Companies were under obligations to supply within their districts; and to enable them to meet those obligations, statutory powers had been given to them to draw water from the Colne in cases of emergency. He was not in a position to go behind the powers which had been conferred by Parliament upon the Joint Committee.

Mr. *W. Clarke* gave evidence as to the works intended to be carried out. With regard to the abstraction of water by the Committee, he said if there were 250 million gallons of water flowing over the Bell Weir, and concurrently only 50 million gallons in the Colne, they could under their powers take the whole of the Colne water, and convert that stream into a dry ditch. They had the right to draw up to 100 million gallons from the Colne. The existence of these powers would depreciate the value of the property in a marked degree.

Mr. FREEMAN said he did not intend to go further, but asked that the other side should put in a definite shape what concessions they were prepared to make, so that Mr. Gregory's surveyors might have an opportunity of seeing how such concessions affected the valuation.

Mr. BAGGALLAY said he did not intend to make any further concession, and certainly not with regard to the Committee's right to take the water of the Colne.

On the resumption of the proceedings on the following day,

Mr. FREEMAN read a letter from the Solicitors of the Committee, embodying the concessions which had been offered at the previous sitting. These were, briefly, the erection of a bridge 12 feet wide over the open aqueduct in the meadow, the provision of two watering-places for cattle, and the exclusive right of fishing in the Colne Brook from the Committee's lands.

Further evidence was then given for the claimant.

Mr. *R. Vigers* said the estate was a very desirable property. In carrying out the works there would be a good deal of temporary inconvenience and disturbance; and he considered that £3000 was not too large a compensation for the general damage to the estate. This, with the value of the land, which, with 10 per cent. for compulsory sale, he put at £1251, made £4251, from which he deducted £100 for the bridge, leaving £4151. To this he added £500 for the possible damage by the taking of the Colne waters, making his total £4651.

Mr. *D. Watney* said he valued the land in the park at £250; and the 2¾ acres of meadow, at £200 per acre, at £555. These sums, with 10 per cent. for compulsory sale, made £885. The loss during the construction of the works and the general depreciation of the estate he estimated at £1790, making £3675. In his opinion, £500 should be added for the restoration of the park, and £500 for the water abstracted from the Colne. Deducting £100, as the value of the bridge to be provided, his total valuation came to £4575.

Mr. *H. Martin* produced his valuation, which came to £4365.

This concluded the case of the claimant.

Mr. BAGGALLAY then addressed the Umpire for the Joint Committee. He contended that the case was of a special character, and that the special circumstances were dealt with in the Staines Reservoirs Act of 1896, the whole of section 50 of which was for the protection of Mr. Gregory. The Committee undertook to carry underground the aqueduct to the west of the Colne Brook, to cover it with efficient works, and to restore the soil as nearly as possible before the work was begun. An easement was to be taken of the land; and the whole works were to be completed in one year. By the section named, it was declared that the making of the conduit should be compensation for the severance of the land; and the learned Counsel contended that, with regard to the lands on the west side, only two things could be considered by the Umpire—the value of the easement of the land and the compensation for loss during the construction of the works. He urged that the injury to the estate had been greatly exaggerated, and that a considerable reduction should be made in the claim.

The sitting was then adjourned till the next day, when evidence on behalf of the Committee was called.

Mr. *R. E. Middleton*, Joint Engineer of the scheme with Mr. Walter Hunter, was the first witness. He said at the easement portion of the land the width of the conduit was 21 ft. 5 in., and with staging 22 ft. 6 in. The width of the easement they were empowered to take was 30 feet. After the completion of the tunnel, they would make good the ground according to the Act. As to the maintenance of the aqueduct, it would only be necessary to inspect the tunnel (say) once a year, when some engineer would walk along the surface. Except this, there would be no interference with the property. The aqueduct would cross the Colne Brook by two steel syphons sunk below the bed of the river, which could not be further interfered with. There could be no damage from this work. When there was a flow of 300 million gallons over Penton Hook Weir, there would be a flow of about 24 millions in the Colne Brook. Their intakes from the Thames measured 80 square feet, and from the Colne only about 10·8 feet. He did not apprehend any difficulty as to the Colne Brook. It would not be to their interest to take the Colne water when the Thames was in good order; and at the only times they might take any there would be plenty of water in the Colne.

In cross-examination, witness said the length of the land through the park over which they had an easement was 1067 feet. Of this, 890 feet would be raised above the present level; but the rise would undulate, and would be sloped off at the sides. The width of the land taken in the meadow was 100 feet, and the aqueduct was about 15 feet wide. This extra quantity of land had been secured in case it should be necessary to make four aqueducts. They had statutory powers to take 100 million gallons a day from the Thames, the Colne, the Wraysbury, and other streams. They had no intention of taking the whole flow of the Colne; but, of course, there might be occasions when, in the interests of the water consumers, they would be obliged to do it.

In re-examination, witness said the Committee had no intention of depleting the Colne. There might be a remote contingency when they would take the waters of the Colne Brook; but it would only be in case any accident occurred to their sluices from the Thames.

Mr. BAGGALLAY said Mr. Hunter was present, if his friend desired to cross-examine him on any point.

Mr. FREEMAN said he did not wish to do so. He had obtained all the information he wanted from Mr. Middleton.

Sir *J. Whittaker Ellis* said he was well acquainted with the property, and, without wishing to disparage it, it was not the estate he should have chosen. With regard to the value, he considered, for the purposes of the Committee, the land in the park was worth £200 per acre. He gave one-half the value for the easement, or £100; and if he added £100 for loss and disturbance during construction, he thought this would be a proper figure. The meadow land, 2¾ acres, he thought worth £4 an acre, which at 25 years' purchase would be £100. In his view, a fair compensation would be £150 an acre, which, with 10 per cent. for compulsory sale, would come to £453. With regard to the injurious affection of the land, he thought £500 would be ample compensation. In his opinion, the estate was not injured at all. His total valuation was £1153.

Mr. *E. Tewson* and Mr. *E. H. Bousfield* entirely concurred in the estimate submitted by Sir Whittaker Ellis.

Mr. BAGGALLAY, in summing up, submitted that the figures adduced on behalf of the claimant were too grotesque to be of any use, and that the valuation of the witnesses for the Joint Committee was alone reliable.

Mr. FREEMAN having replied,

The UMPIRE said he would make his award at an early date.

THE BRIDLINGTON WATER-WORKS PURCHASE QUESTION.

Dissatisfaction with the Award.

The award in the Bridlington Water-Works purchase arbitration, the terms of which were given in the "JOURNAL" for the 22nd ult. (p. 1176), is giving rise to considerable dispute, as a section of the Urban District Council and a large number of the townspeople are not altogether satisfied with the sum to be paid by the town to the Water Company for the undertaking. The price was fixed at £66,260; and it is estimated that, with stock-in-trade, valuation, pensions, and other items, the concern cannot cost Bridlington less than from £70,000 to £73,000. It was recently reported "on absolutely reliable authority" that a private meeting of the Water Supply Committee had been held; and a motion recommending the Council to meet the cost of the works by loan or otherwise was duly seconded, but was thrown out by a substantial majority of the Committee. The exact terms of the amendment did not leak out; but there was said to be good ground for believing that the majority of the Committee were desirous of obtaining Counsel's opinion as to the validity of the award itself. It was also reported that the members of the Water Committee have been at "sixes and sevens" with their Chairman (Mr. Townsend) since he proposed in the Council, and carried in opposition to their votes and desires, that the services of the already retained Umpire should be dispensed with, and that the Arbitrators (Mr. G. F. Deacon, for the Council, and Mr. Thomas Newbigging, for the Company) should decide upon the price.

A crowded meeting of the ratepayers was held on Monday last week to consider the question. Mr. J. Stuart presided, and characterized the price to be paid as "horrible." The effect of the award was that the ratepayers would have to part with £70,000, which was considerably more than one year's value of the property in the district. If they borrowed money at or about 3 per cent., and had to repay in a period not exceeding fifty years, this would mean that they would have to pay £2800 a year. It was generally acknowledged that a considerable amount of money—at least £5000—would have to be spent to bring the works up to date; and this meant that they would have to pay £3000 a year. The revenue of the Water Company for the past year only had been taken; and they could not expect such a period of prosperity again for some time. He condemned the action of the Council in dealing with the matter with closed doors. If the ratepayers refused the award, it could not be enforced. He moved a resolution that the Council be urgently requested to confirm the resolution of the Water Committee, that Counsel's opinion should be taken as to the validity of the award before making arrangements to borrow money; and, if it was found to be invalid, that advice should be sought as to the course to be adopted for having it set aside. Mr. Bailey seconded the motion, and it was carried with enthusiasm.

At the monthly meeting of the District Council on the following day, the water question was the principal subject discussed at a sitting which occupied eight hours—closing at half-past two o'clock on Wednesday morning. The proceedings were unique in the annals of the town; and, according to the reports in the local papers, were nothing short of disgraceful. A deputation from the meeting of ratepayers held on the previous day attended, to present the resolution then passed. Mr. Pool moved the confirmation of the minutes of the last meeting of the Water Committee, containing the resolution to advise the Council to obtain an opinion as to the validity of the award. He stated the grounds on which the award might be questioned; among them being the facts that the Council's Arbitrator had obtained his information and the Accountants had examined the books *ex parte*, and that the Arbitrator had accepted the hospitality of the Water Company. Mr. Townsend, the Chairman of the Committee, interrupted the speaker with a question; whereupon someone made a remark in which occurred the word "jackass." The Chairman (Mr. F. Creaser) appealed to the members to conduct the business in a more gentlemanly way. Speeches went on till half-past nine, when there was an adjournment for refreshments. On resuming, Mr. Bradford spoke for an hour, amid frequent interruptions from Mr. Townsend, who had on several occasions to be called to order. Mr. Bradford condemned the action of the Chairman in having presided over the meetings of the Council while he was a Director of the Water Company. Mr. Sutcliffe gave his legal opinion that it was useless to go forward with the resolution. Mr. Barr pointed out that the Chairman of the Committee would not allow them to ask questions of their Arbitrator

when they were of a certain nature, unless he prefaced them. He said the fact was that the members of the Committee did not dare to speak on the matter except with bated breath. After further discussion, the room was cleared in order that the Council might receive the private opinion of their Solicitor as to the usefulness of the resolution. When the public were again admitted, and a vote was taken, five were for the confirmation of the minutes and five against. They were therefore not adopted; and the award was sent back to the Water Committee for consideration and report. Mr. Townsend afterwards informed the representatives of the Press that he had resigned his position as a member as well as Chairman of the Committee.

In consequence of the dissatisfaction which exists in Bridlington at the District Council's disinclination to take Counsel's opinion as to the validity of the award, a number of influential gentlemen in the town and district are taking steps to obtain an opinion on their own account.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Provost Bennet, of Leith, presided at the monthly meeting of the Edinburgh and Leith Gas Commissioners on Monday. The business was not important. The report of Mr. W. R. Herring, the Engineer, showed that there had been an increased output of gas during October, as compared with the same month of last year, of 6,534,200 cubic feet; and since May 16, as compared with the corresponding period of last year, of 11,760,300 cubic feet. Bailie Kinloch Anderson said that the increase was very satisfactory. Mr. Gibb, the Treasurer, reported that he had been able to obtain on loan the £10,000 which was wanted, and that he had also borrowed £5950, repayable at seven days' notice, which he could economically use for the purposes of the Commission. This was approved of. The appointment of Committees and other formal business followed; Bailie Kinloch Anderson being re-elected Convener of the Works Committee, and Bailie Maclark Convener of the Finance and Law Committee. The Finance and Law Committee reported having made what is probably the largest payment the Commissioners have ever had to make at one time—namely, £185,460 17s. 8d. In this sum there was included £125,353 as the price of the new site at Granton.

The Pluto Hot-Water Syndicate have been granted permission to erect six lamps in Glasgow. They are to pay a nominal rent of 1s. per lamp for the first year, at the end of which time the rent is to be revised. The lamps are to be erected free of charge to the Corporation, and are to be removed when the Corporation require it. The Syndicate are also to relieve the Corporation of all responsibility for any accident or claim arising from the use of the lamps.

The Arbroath Gas Corporation, on Monday night, considered a letter from Edmundson's Electricity Corporation, of London, asking that an agreement should be entered into with them, under which they would have power to apply for a Provisional Order for the lighting of Arbroath in certain events; but the Gas Corporation thought that the application was merely a bid for business, and they resolved to decline to enter into any agreement.

The supply of acetylene gas at Cowdenbeath by the local Gas Company, seems to be in a position of greater difficulty than has hitherto been realized. I give the following from the "Dunfermline Journal" of to-day; but as the narrative bears evidence of somewhat loose construction, I would recommend that it be not held to be a final pronouncement on the subject: "The question of the gas supply of the burgh, which for some time back has been the cause of much anxiety to the shopkeepers (we say shopkeepers, because the ratepayers as a whole are not in possession of a gas supply), seems now to have reached a climax. It is hardly necessary at this time to go into the details connected with the question. Suffice it to say that, previous to Sept. 3, the consumers were supplied with oil gas at a cost of 12s. 6d. per 1000 cubic feet. The quality of the oil gas supplied, however, was such that it was considered advisable to have a change; and the Directors of the Gas Company agreed to introduce acetylene gas. The gas has been used in the burgh for nearly three months; and those who have seen it admit that it is a great improvement on the oil gas. The shopkeepers very willingly took to the new light, and freely commented on the brightness of it as compared with the oil gas. There was one feature, however, in connection with the new gas which had not been fully considered—the cost. Consumers were fully prepared to pay more than the price charged for the oil gas; but they never anticipated that the price would be raised from 1s. 3d. per 100 cubic feet to 10s. per 100 cubic feet. The shopkeepers protested against the price; and a meeting of those interested was held. At the meeting, a Committee was appointed to meet the Gas Company's Directors, with a view, if possible, to have the price reduced. At this meeting, we understand, the shopkeepers' representatives considered that 5s. was a fair price for 100 cubic feet; and they were willing to pay this sum. No arrangements, however, could be arrived at, and the meeting broke up without any guarantee being given that the price of the gas would be reduced. It was stated at the meeting that 100 cubic feet of acetylene gas cost the Directors 11s. 9d.; and that they were selling it at a sacrifice to the shopkeepers. A meeting of shopkeepers was held on Tuesday, when there was a representative gathering. The *pros* and *cons* of the situation were again gone into; and it was unanimously agreed to be done with the gas after Tuesday next. The Secretary of the meeting was instructed to inform the Clerk of the Gas Company to take a reading of the meters after Tuesday. During the week, the Gas Company have again introduced the oil gas, with the result that the light given forth by the burners used for the acetylene gas is of the most miserable description. Such a state of matters in the burgh of Cowdenbeath is to be regretted; but we hope that some party or parties will come forward, having as their motto—Let there be light. We understand one shopkeeper intends to manufacture acetylene for his own use."

In the Hamilton Town Council an attempt has been made to violate that first principle in the conducting of all works, of whatever sort—that the Manager shall have absolute control of the staff. In this instance, it was the appointment of the works foreman, which it was intended should be taken out of Mr. Ewing's hands. Mr. Ewing was appointed to the Hamilton works in 1892. Before then, on account of the state of health of his predecessor, the Corporation had appointed a foreman; and he remained on, on his original appointment. He resigned eight months afterwards, however; and then Mr. Ewing was given absolute power in the filling up of the vacancy. Matters prospered in the works, as we all know, until July of this year, when a man, who had been a labourer, was dismissed by Mr. Ewing. This person had influence in the Council; and he was sent back to the works as foreman. The result is said to be insubordination among the men in the works, and unsatisfactory results in the working. The subject was before the Town Council on Monday, when Mr. Ewing was able to show, by figures, what the loss amounted to, and how it had been caused. The foreman's friends in the Council endeavoured to depreciate Mr. Ewing's services. Those who wish the support of the workmen always strike at the man in authority. Their doctrine seems to be that everyone should do as he pleases. Where such beliefs prevail, the demoralization of the working staff follows. This was what was happening in Hamilton; but it happily is now about to be put a stop to. Only two members of the Council favoured divided management; and the Committee have come to the conclusion that Mr. Ewing should have absolute power, as before.

The policy of popularizing the gas supply is succeeding at Dumfries. It was reported to the Town Council on Thursday that since May 15 the number of prepayment meters has increased from 240 to 385; that there are now 565 gas-cookers in use; and that the consumption of gas since that date has been 3 million cubic feet more than has ever been experienced in the same period.

Mr. J. B. Terrace, of Brechin, has introduced the eight-hour day for workmen employed in the gas-works there. It is to be tried for three months. There is no increase in the number of men, nor reduction of wages; and every man charges in eight hours the same number of retorts as he did formerly in ten hours. I have not heard of the short day being introduced into so small a works as Brechin—which shows that in this matter, as in others, Mr. Terrace always likes to be in the van.

The Stirling Gas Company have recently made application to the Sheriff to have their undertaking valued by Her Majesty's Assessor of Railways and Canals for Scotland, instead of by the local assessors, as formerly. The Burgh Commissioners of Alloa have made similar applications as regards their gas and water works. These applications are made under section 23 of the Valuation of Lands (Scotland) Act, 1854; the intention of the Legislature in this enactment apparently being to give companies or corporations who own continuous works liable to be assessed in more than one parish, county, or burgh, the option of having their undertakings placed under a Government official, whose jurisdiction is not limited to a single county or burgh, but who has power to value the works as a whole, and then allocate the just proportions to each rating area.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 3.

Sulphate of Ammonia.—The firmer tone referred to in the last report was scarcely maintained in the early part of the week; prices becoming again somewhat irregular. But towards the close, the market is rather firmer; and the quotations are £10 per ton f.o.b. Hull and Leith, and £10 1s. 3d. per ton f.o.b. Liverpool. Consumers have come more into line with current prices, and have taken fair quantities; but speculators, though ready to avail themselves of tempting offers, have refrained from large operations. Scotch makers are firm, at £10 5s. per ton, ordinary terms, f.o.b. Leith, for delivery over the spring months; and it is reported that this price has been paid in one or two instances, but buyers abroad do not respond. London quotation remains £10 per ton, Beckton terms, for January-June delivery, without attracting buyers.

Nitrate of Soda continues at 7s. 6d. per cwt. for ordinary and 7s. 7½d. per cwt. for fine quality, on spot. In the forward position, there is a firmer feeling; and some improvement in values.

LONDON, *Dec.* 3.

Tar Products.—This market is disappointing in every respect, except in the one article of creosote, which is in fair demand and moving off freely. Pitch is somewhat easier, though there is a demand equal to the production. Higher freights have somewhat interfered with shipping pitch, and have undoubtedly upset many calculations in respect to this particular business. Benzols continue their uninteresting and unprofitable career, although the growth of the home consumption of this article is encouraging to English distillers. There is some inquiry for naphthalene in its several states; but buyers' ideas of value are so low that few makers will care to extract it from the oils.

To-day's values may be taken as: Tar, 14s. 6d. to 20s. Pitch, east coast, 25s.; west coast, 22s. Benzol, 90's, 8½d.; 50's, 8¼d. Toluol, 1s. Solvent naphtha, 1s. 2d. Heavy naphtha, 1s. 1½d. Crude, 30 per cent. naphtha, 3½l. Creosote, 3d. Heavy oils, 45s. Carbolic acid, 60's, 1s. 10½d. Creosote salts, 30s. Anthracene, nominal, "A," 4d.; "B," 3d.

Sulphate of Ammonia is not quite so firm; and buyers are generally offering a little less money. But stocks are low; and the home consumption is likely to be extremely large. Makers are at the moment independent; and it is unlikely that any serious drop in price will take place. Nominal value is £10 per ton, less 3½ per cent. at all ports.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The improvement reported in the coal trade of this district last week is fully maintained; a continued increasing demand coming forward on all descriptions of fuel. This is not only keeping pits on full time, but is necessitating the filling up out of stocks in many cases to meet present requirements. The better qualities are generally in fairly active request for house-fire purposes; and prices are exceedingly firm at the full list rates. But there is no quoted advance upon last month, though the tendency is to harden up in some special cases. At the pit mouth, best Wigan Arley remains at about 11s. to 11s. 6d. per ton; seconds and good medium Arley range from 10s. to 10s. 6d.; good Pemberton four-feet, 9s. to 9s. 6d.; and common house coal, 8s. to 8s. 6d. The lower class round coals are in brisk demand, with a hardening tendency in prices, though general quotations are much the same as last month—averaging 7s. 9d. to 8s. 3d. per ton at the pit.

For shipment, there is a fair inquiry; but business is rather restricted, owing to the scarcity of vessels and the advance in freight. Delivered at the Mersey ports or in the Manchester Ship Canal, ordinary steam coals average 9s. to 9s. 3d. per ton. For all descriptions of engine fuel there is quite a pressing demand; and with many of the leading collieries unable to meet the requirements of their regular customers, there is a scarcity of supplies on the market. This position has been gradually accentuated during the past few weeks, with a stiffening up in prices; and there has been with the commencement of the month an officially announced advance of 3d. per ton in the West Lancashire, and 5d. per ton in the Manchester district, on all descriptions of slack and burgy. Nuts have also been advanced 5d. per ton. This represents an upward move of 9d. per ton in the West Lancashire district, and 10d. in the Manchester district, over the prices ruling this time last year. At the pit, common slack is not now quoted below 3s. 9d. to 4s. per ton; good medium sorts, 4s. 6d. to 4s. 9d.; and best qualities, 5s. 3d. to 5s. 6d.

Northern Coal Trade.—There has been a continued full demand for coal; and the range of prices is rather higher than it was, while there is now a pressure to get fuel shipped before the holidays. In best Northumbrian steam coals, the price is firm at from 9s. 6d. to 9s. 9d. per ton f.o.b.; second qualities are 9s.; and steam smalls are about 5s. Manufacturing coals are steady, with a large business doing at rather higher prices for next year's supply. Gas coal is irregular; and there is a disposition to quote for next year's contracts at prices considerably below those that are current. For immediate delivery, the quotation is from 8s. 9d. to 9s. per ton f.o.b.; while for deliveries over next year, the prices now quoted may be said to average about 8s. per ton f.o.b. At present, the output is about the highest in the year; and if storms do not interfere with the arrival of steamers, it may be expected that there will be the delivery of the heaviest requirements of the year before the end of the next fortnight. The price of gas coke shows no alteration this week.

Scotch Coal Trade.—During the past week prices for coal generally improved. A formal advance of 1s. per ton for splint has been announced; the reason given being that on account of a scarcity of railway waggons there is broken time at the pits. If railway waggons are scarce, the inference is that they are being sent longer journeys than usual—that is, into England—which would make it easy to account for firmer prices all round. The prices quoted are: Main, 8s. 3d. to 8s. 6d. per ton f.o.b. Glasgow; ell, 9s. to 9s. 3d.; and splint, 9s. 9d. to 10s. The shipments for the week amounted to 170,850 tons—an increase upon the previous week of 440 tons, and upon the corresponding week of last year of 4929 tons. For the year to date, the total shipments have been 8,856,392 tons—an increase upon the corresponding period of last year of 1,409,610 tons.

Ramsgate Corporation Gas and Water Supply.—The Ramsgate Town Council have resolved, on the recommendation of the Gas Committee, to apply to the Local Government Board for sanction to borrow £20,000 in respect of the water, and £30,000 on account of the gas undertaking—the latter to include the amount required for the purchase of the Minster Gas-Works.

Service-Pipes and Street Paving.—A peculiar obstacle to the extension of the prepayment-meter system has presented itself at Devonport. Some difficulty has arisen with the Corporation respecting the repair of the pavement of the footpaths after the laying of service-pipes. Many of the paths are laid with a patent covering known as Coverack, the repair of which is troublesome. In consequence of the difficulties raised by the Corporation, the Directors of the Gas Company have decided to refuse all applications for the supply of gas by automatic meter where it is necessary to break up this pavement to give the supply.

Tar Distilleries in Holland.—We are informed that the liquidation of the oldest of the three Dutch tar distilleries has now been completed by the repayment to the shareholders, on each share of 1000 fls. nominal value—the sum of 327·50 fls. The Limited Company—the Maatschappy voor Chemische Industry (Society for Chemical Industry), formerly the Nederlandsche Roolteerstokery (Netherlands Coal Tar Distillery)—at Amsterdam, with a nominal capital of 685,000 fls. in shares of 1000 fls. (the effective capital being 235,000 fls.), has thus returned 685 × 327·50 = 224,337·50 fls.; while the dividends paid from 1861 to 1893 have been 652 per cent. in all.

Electric Light in Kandy (Ceylon).—For some time past negotiations have been under consideration, and now a contract has been signed, by which the Colombo Gas and Water Company, Limited, have obtained the monopoly of supply of electricity in the hill capital of Ceylon. Situated some 70 odd miles inland, at an altitude of 1650 feet above sea-level, and means of communication being by railway, there is much traffic through the place. The scheme includes 200 incandescent lamps in the streets and five 7-ampère arc lamps at the busiest spots. The Government buildings and private houses are to be lighted, and the Council are reducing the police in view of the requirements of the town and the introduction of the electric light. Mr. T. S. Cleminshaw, Assoc.M.Inst.C.E., is the Manager of the Company, and Mr. J. E. Addyman, Assoc.M.Inst.E.E., the Electrical Engineer, is at present in England conferring with the London Board of Directors as to the details of the scheme.

The Dorchester Corporation and the Gas-Works.—The proposal of the Dorchester Corporation to purchase the undertakings of the Dorchester Gas and Gas-Fittings Companies, for which, as mentioned in the "JOURNAL" last week, they are desirous of obtaining parliamentary sanction, is not being received very cordially by the ratepayers; for, at the statutory meeting on the 28th ult., the resolution approving of the decision of the Corporation to promote a Bill received the support of only about a score of persons, while, according to a local paper, a "forest of hands" were raised against it. The Mayor (Alderman G. Davis), who presided, consequently had to declare the motion lost. As the people were leaving the meeting, an opponent of the purchase scheme, obviously labouring under a misconception as to the result of the voting, demanded a poll. He subsequently, however, explained to the Mayor that he was perfectly satisfied with the result of the show of hands. The following morning, the Town Clerk received a letter from him formally expressing his desire to withdraw his demand for a poll, in order to save unnecessary expense to the town. But a protest against the adoption of this course having been made, the poll has been fixed to take place on the 29th inst.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1283.

Issue.	Share	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20⅛—21⅛	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	16—17	..	4 8 3
300,000	100	July 1	5	Australian 5 p. c. Db.	105—107	..	4 13 6
200,000	5	Nov. 11	6	Bombay, Ltd.	6⅛—6⅜*	..	4 2 11
40,000	5	,,	6	Do. New, £4 paid	4¼—4⅜*	..	5 1 1
380,000	Stk.	Aug. 12	12	Brentford Consolidated	275—280	..	4 5 9
240,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Prf.	140—145	..	3 9 0
159,375	,,	June 10	4	Do. 4 p. c. Db. Stk.	130—135	..	2 19 3
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	263—268	..	4 5 10
226,320	,,	,,	8½	Do. A. Ord. Stk.	190—195	..	4 7 2
933,500	Stk.	Aug. 31	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	49—50	..	4 0 0
50,000	10	Aug. 12	11½	Bromley, Ord. 10 p. c.	25—27	..	4 5 2
75,000	10	,,	8½	Do. 7 p. c.	20—22	..	3 17 3
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd	9½—10	..	6 0 0
98,122	Stk.	June 29	4	Do. 4 p. c. Db. Stk.	98—100	..	4 0 0
150,000	20	July 14	8½	Cagliari, Ltd.	29—30	..	5 10 0
100,000	10	Sept. 29	7	Cape Town & Dis., Ltd.	14—15	..	4 13 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	310—315	..	4 5 9
200,750	,,	,,	10½	Do. New do.	240—215	..	4 5 9
200,750	,,	June 10	4½	Do. 4½ p. c. Db. do.	147—152	..	2 19 3
800,000	Stk.	June 10	10†	Continental Union, Ltd.	205—210	..	4 15 3
200,000	,,	,,	7†	Do. 7 p. c. Prf.	190—195	..	3 11 10
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	305—310	..	4 10 4
168,400	,,	,,	11	Do. B 7 p. c.	255—265	..	4 3 0
555,000	Stk.	Aug. 12	5½	Crystal Palace Ord. 5 p. c.	125—130	..	4 0 9
60,000	,,	,,	5	Do. 5 p. c. Prf.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	23—24	..	4 11 8
354,060	10	,,	11	Do. £7 10s. paid	17—18	..	4 11 9
5,922,230	Stk.	Aug. 12	12½	Gaslight & Coke, A, Ord	283—288	+1	4 5 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	120—125	..	3 4 0
665,000	,,	,,	10	Do. C, D, E, 10 p. c. Prf.	308—313	..	3 3 11
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	152—157	..	3 3 8
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	223—238	..	3 3 0
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	195—200	..	3 10 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	308—313	..	3 3 11
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	185—190	..	3 3 2
1,061,150	,,	June 10	4	Do. 4 p. c. Db. Stk.	131—133	..	3 0 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	148—153	..	2 18 10
958,000	,,	,,	6	Do. 6 p. c. do.	195—200	..	3 0 0
70,000	10	Nov. 11	8	Hongkong & China, Ltd.	13½—14½	+½	5 10 4
3,800,000	Stk.	,,	10	Imperial Continental	224—226	+1½	4 8 6
376,400	100	Aug. 2	4	Do. 4 p. c. Dbs. Red.	98—101	..	3 19 3
473,600	Stk.	Aug. 12	3½	Do. 3½ p. c. Db. Stk.	102—105	..	3 6 8
560,000	100	Oct. 1	5	Met. of Melbourne	5 p. c. Db.	110—112	..	4 9 3
250,000	100	,,	4½		4½ p. c. Db.	105—107	..	4 4 1
					* Exdiv.		
75,000	5	Nov. 30	6	Malta & Medn., Ltd.	4⅜—5½*	+½	5 14 3
541,920	20	Nov. 11	5	Monte Video, Ltd.	13—14	..	7 2 10
617,946	Stk.	Aug. 31	9¾	Newc'tle & Gatesh'd Con.	232—234	..	4 2 8
252,325	Stk.	Jan. 3	8½	Do. 8½ p. c. Db. Stk.	113—117	..	2 19 10
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7⅝*	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6¼—6⅜*	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1⅜*	..	4 11 5
60,000	5	Sept. 29	7	Ottoman, Ltd.	5—5½	..	6 6 2
500,000	100	Dec. 1	6	People's Gas 2nd M. of Chicago Bd.	102—105*	+1½	5 13 2
848,070	10	Oct. 13	6	River Plate Ord.	9⅛—9⅜	..	6 3 1
250,000	Stk.	June 29	4	Do. 4 p. c. Db. Stk.	99—101	..	3 19 3
250,000	10	Sept. 29	10	San Paulo, Ltd.	15—16	+½	6 5 0
135,000	Stk.	Sept. 15	10	Sheffield A.	242—245	..	4 1 8
209,053	,,	,,	10	Do. B.	242—245	..	4 1 8
447,427	,,	,,	10	Do. C.	242—245	..	4 1 8
5,600,000	Stk.	Aug. 12	5½	South Metrop., 4 p. c. Ord.	138—142	..	3 15 1
1,460,000	,,	July 14	3	Do. 3 p. c. Db. Stk.	102—105	..	2 17 2
60,000	Stk.	Aug. 31	12	Tottenham and A.	280—290	..	4 2 9
60,000	,,	,,	9	Edmonton B.	200—210	..	4 5 9
182,380	10	June 10	7	Tuscan, Ltd.	10⅜—11½	..	6 1 9
149,900	10	July 1	5	Do. 5 p. c. Dbs. Red.	100—103	..	4 17 1
				WATER COMPANIES.			
746,164	Stk.	June 29	10½	Chelsea, Ord.	313—318	..	3 6 0
150,000	,,	,,	5	Do. 5 p. c. Prf.	170—175	..	2 17 2
160,000	,,	,,	4½	Do. 4½ p. c. Pf. Stk., 1875	148—152	..	2 19 3
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Db. Stk.	155—160	..	2 16 8
1,720,560	Stk.	Oct. 13	7	East London, Ord.	212—217	..	3 4 6
654,740	,,	June 29	4½	Do. 4½ p. c. Db. Stk.	158—162	..	2 15 7
890,000	,,	,,	3	Do. 3 p. c. Db. Stk.	103—105	..	2 17 2
700,000	50	June 29	7½	G'd Junct'n, 10 p. c. max.	115—118	..	3 3 7
310,000	Stk.	Sept. 29	4	Do. 4 p. c. Db. Stk.	138—143	..	2 15 11
708,000	Stk.	Aug. 12	14	Kent	365—370	..	3 15 8
160,000	,,	,,	7	Do. New, 7 p. c. max.	212—217	..	3 4 6
1,043,800	100	June 29	10½†	Lambeth, 10 p. c. max.	300—305	..	3 8 10
406,200	100	,,	7½	Do. 7½ p. c. max.	230—235	..	3 9 10
850,000	Stk.	Sept. 29	4	Do. 4 p. c. Db. Stk.	138—143	..	2 15 11
500,000	100	Aug. 12	12¼	New River, New Shares	432—437	..	3 0 8
1,000,000	Stk.	July 28	4	Do. 4 p. c. Db. Stk.	138—143	..	2 15 11
902,300	Stk.	June 29	6	Southw'k & V'xhall, Ord.	170—175	+3	3 8 7
126,500	100	,,	6	Do. do. 7½ p. c. max.	162—167	+2	3 11 10
489,200	Stk.	,,	5	Do. do. 5 p. c. Prf.	170—173	..	2 17 10
1,019,585	,,	Oct. 13	4	Do. 4 p. c. A Db. Stk.	138—143	..	2 15 11
1,155,066	Stk.	June 10	10	West Middlesex	295—300	..	3 6 8
200,000	,,	,,	4½	Do. 4½ p. c. Db. Stk.	162—165	..	2 14 7
200,000	,,	Sept. 15	3	Do. 3 p. c. Db. Stk.	102—105	..	2 17 2
					* Ex div.		

† Next dividend will be at this rate.

Sulphate of Ammonia Plant for the Ilford Gas-Works.—The Ilford Gas Company are at present erecting a complete sulphate of ammonia plant (Dr. Feldmann's process), to the plans and designs, and under the supervision of, Mr. J. H. Brown, the Company's recently appointed Assistant-Manager.

Gas and Electricity Affairs at Leigh.—The Leigh District Council were last Tuesday informed by the Gas, Water, and Electricity Committee that a letter had been received from the Local Government Board sanctioning the borrowing of £18,860 for gas-works extensions, and of £10,216 for the erection of electricity works.

Entertainment at the Midland Iron-Works, Donnington.—The sixth annual smoking concert in connection with the Midland Iron-Works took place (by permission of the Executors of the late Mr. Charles C. Walker) in the dining-hall, on Saturday, the 26th ult. There was a very large attendance—the spacious hall being packed; and the audience were most enthusiastic. The concert was, as usual, excellently arranged. The President of the movement was Mr. Alfred Featherstone; and the Vice-Presidents, Messrs. H. Howell and T. Palin. The Hon. Sec. and organizer was Mr. W. W. Martin. During the evening, the President took the opportunity of congratulating the men; saying they were second to none in the world. As long as the men of Donnington turned out the work in the excellent manner they now did, they need have no fear of being short of employment. Mr. Featherstone moved a cordial vote of thanks to the performers, and especially referred to the energy put into the work of the Donnington Orchestral Society by Mr. W. W. Martin, the Conductor. Mr. Palin proposed a vote of thanks to the Chairman; and it was received with much enthusiasm. The National Anthem closed one of the most successful "smokers" held at Donnington.

Birmingham Corporation Water Supply.—In a report prepared by the Water Committee of the Birmingham City Council for presentation at the next meeting of that body, they state that during the severe drought of the past summer the demand for water was greater than at any former time. In several weeks the consumption was more than an average of 20 million gallons per day; and for the twelve weeks to the end of September reached an average of over 18·8 million gallons per day, as against 17·6 million gallons for the twelve weeks of highest consumption in 1897. The heavy demand being naturally coincident with a largely reduced yield by the streams from which a considerable proportion of the supply is obtained, led to a very serious draft upon the storage; and the Shustoke reservoir was drawn down to a point far below any previous record. The consumption of water for street and road purposes was reduced to the lowest point short of absolute cessation; and urgent appeals were made to the public to exercise economy. During the summer all the reservoirs in the neighbourhood of Birmingham were maintained at their full level; and this enabled the department to give an uninterrupted and unrestricted supply. The population served is rapidly increasing, with the natural consequence that the legitimate demand will be greater year by year, and the possibility of securing a temporary increase from existing sources is engaging the attention of the Committee. The exceptionally fine weather of the past summer enabled good progress to be made with the works in the Elan Valley. The Water Committee further report that contracts have been entered into with Messrs. Morrison and Mason, Limited, of Glasgow, for additional sections of the new aqueduct from Downton to Cleobury Mortimer and from Cleobury Mortimer to Hagley. The first of these (contract No. 11) covers a length of about 14½ miles, of which 7¼ miles is in cut-and-cover, 6⅛ miles in syphon, and 1½ miles in tunnel. The amount of the contract is £489,930. The second of the sections mentioned (contract No. 12) covers a length of 17¾ miles. The whole of it is in syphon. In it are comprised eight stream crossings, including bridges over the Rivers Severn and Stour and the Staffordshire and Worcestershire Canal. The amount of the contract is £412,446. The whole of the contracts on the aqueduct are now let, except a short length of about 5 miles from Hagley to Frankley.

The Quality of the Belfast Water Supply.—An outbreak of typhoid fever in Belfast has led to defamatory statements being made regarding the water supply. In order to controvert these, the Commissioners requested Professor J. F. W. Hodges, F.I.C., and Mr. Robert Barklie, F.I.C., to report upon the supply. The first-named gentleman collected in different parts of the city eight samples from houses which were not altogether above suspicion from a sanitary point of view. His examinations, however, satisfied him that the samples were free from injurious micro-organisms. Further samples were taken from the water-works, and subjected to various tests. No smell could be detected; in taste the water was palatable; and the suspended matter was in minute quantity, and of no hygienic importance. Professor Hodges did not consider the waters were polluted with animal matter, though they did contain organic matters of vegetable origin somewhat in excess of the quantity found on a previous examination. Mr. Barklie's report made it clear that the filtration of the water is highly efficient; and his examinations enabled him to express the opinion that the supply is at present purer than at any previous period, and that the cause of the present outbreak of typhoid fever must be sought for elsewhere.

Additional Water Supply for Lincoln.—Professor E. Hull, F.R.S. has reported to the Lincoln Corporation on the water supply of the city, and the possibilities of increasing it. He finds that there is every prospect of a successful result attending an experiment for adding to the present supply from underground sources. The city is fortunate above many other large towns in England in having at least three alternative sources of supply, which might be designated respectively: (1) That of the Riseholme district to the north of the city; (2) that of the Dunston district to the south of the city; and (3) that to be found by means of a deep artesian boring near the present pumping-station, lying about a mile to the west of the city. From each and all of these sources, water might, in his opinion, be obtained, so that the question of selection would depend upon the balancing of the advantages and disadvantages of each. Professor Hull recommends the third scheme for adoption. In order to utilize this underground source of supply, it would be necessary to sink a well about 200 feet in depth, and from the bottom to drive a borehole of such diameter that, at the depth of 1200 feet from the floor of the well, the diameter should not be less than 12 to 14 inches. From such a well and boring, he anticipates a supply amounting to about a million gallons per 24 hours.

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SALTLEY WORKS, BIRMINGHAM	2,000,000	BELLEVILLE	250,000
COLCHESTER	300,000	OTTAWA (Second Contract)	250,000
BIRKENHEAD	2,250,000	BRANTFORD (Remodelled)	200,000
SWINDON (New Swindon Gas Co.)	120,000	ST. CATHERINES (Remodelled)	250,000
SALTLEY WORKS, BIRMINGHAM (Second Contract)	2,000,000	KINGSTON, PA.	125,000
WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000,000	PETERBOROUGH, ONT.	250,000
HALIFAX	1,000,000	WILKESBARRE, PA.	750,000
TORONTO	250,000	ST. CATHERINES (Second Contract)	250,000
OTTAWA	250,000	BUFFALO, N.Y.	2,000,000
LINDSAY (Remodelled)	125,000	WINNIPEG, MAN.	500,000
		COLCHESTER (Second Contract)	300,000
		YORK	750,000
		ROCHESTER	500,000

KINGSTON, ONT., ... 300,000 Cubic Feet.

Gift of a Water Supply to a North Yorkshire Village.—Mr. John H. Preston has offered the Norton District Council's spring of water on his estate free, and £200 towards the cost of supplying the village of Burythorpe, Malton, with an efficient water service; the present well system having been condemned by the Medical Officer of Health.

Gomersal Water-Works Purchase.—Mr. H. H. Law, one of the Local Government Board Inspectors, conducted an inquiry at Gomersal last Tuesday with reference to the application of the District Council for sanction to borrow £10,000 for the purchase of the water-works. There was no opposition; the inquiry being quite of a formal character.

Liskeard Water-Works Loans.—In order to defray the cost of the purchase of the water-works, and of obtaining the Act of Parliament passed last session, the Liskeard Town Council have decided to raise loans to the amount of £18,350. Of this sum £16,500 is the cost of the works, £200 stamp duty and other expenses, and £650 the parliamentary expenses. Part of the money is to be borrowed at 2¾, and the remainder at 3 per cent. For the first ten years the annual expenditure, including a charge of £175 for maintenance of the works, is calculated at £890; and as the present revenue of the undertaking is a little more than £900, the Council expect to make a profit from the beginning. In ten years, when the loan for parliamentary expenses is repaid, it is expected that the profit will be at least £75—the amount yielded by a rate of 1d. in the pound.

Chard Water Supply.—The present sources of water supply having been condemned by the Local Government Board, the Chard Town Council met last Thursday to consider what should be done in the matter. A resolution in favour of securing the present springs from risk of contamination was passed. Mr. Dwelly suggested that an artesian well should be sunk at a sufficiently high level; and he offered to give £25 towards the cost. It was decided to hold a special meeting and consider this proposal, which a majority of the Council thought offered a solution of the difficulty. Mr. G. Hudson, the Engineer employed by the Corporation, wrote explaining his reasons for thinking that it would be undesirable to look to the present springs for the future water supply of the town. Although the water might remain perfectly pure for years, it was liable to become infected and to produce an epidemic, which might be at once dangerous and costly.

Newhaven and Seaford Water Company.—The shareholders of this Company met last Tuesday to receive the report and accounts for the year ending September last. The Directors alluded with satisfaction to the success which had attended the Company's application to Parliament for extended powers, in face of bitter opposition. Powers to construct new works, and raise additional capital to the amount of £20,000, had been conferred. It was also stated that considerable extensions had been carried out during the past year; and it was hoped that the whole of the works would be completed early next spring. The new source of supply yielded above 1¼ million gallons per day, and was eminently satisfactory as to quality. As to the accounts, the Directors pointed out that the amount available for dividend was £1611; and they recommended a distribution at the rate of 6 per cent. per annum, and the placing of £150 to the suspense account. The report was adopted.

Prospective Amendment of the Workmen's Compensation Act.—Speaking at a public workers' meeting at Accrington last Wednesday, Mr. W. H. Wilkinson, the General Secretary of the Northern Counties Weavers' Association, representing 80,000 weavers, said he was in a position to state that it was almost certain that when Parliament met the Workmen's Compensation Act would be amended, and that all trades which did not now come within its scope would be brought under its provisions by this time next year.

The Maidstone Corporation and the Water-Works.—The result of the poll recently demanded at Maidstone on the proposal of the Corporation to purchase the water-works was declared last Tuesday as follows: For the purchase, 1975; against, 2536—majority against, 561. The result was very different from what was expected a few weeks ago; and the defeat of the proposal is attributed to a fear entertained by property-owners that the purchase price would be so high as to necessitate an addition to the rates of the borough for some years. When the previous poll on the question was taken (in 1896), the ratepayers decided against purchase by a majority of nearly three to one.

The Winding-Up of the Matlock Water Company.—The final assessment and distribution of the assets of this voluntarily wound-up Company have been resolved upon. The Company, it may be remembered, disposed of their undertaking to the Matlock District Council, for £18,850; the terms being arranged amicably. Mr. F. L. Sowter, of Derby, has had the affairs of the Company in hand as Official Liquidator; and, in his report to the shareholders, he stated that he submitted to the Directors a statement showing the amount divisible among the shareholders, which would be approximately £7 4s. 10d. for each original £5 5 per cent. share, and £14 9s. 8d. for each £10 7 per cent. share. The Directors, however, considered that the basis should be at the rate of the dividend paid on the shares, which would give a distribution of £5 14s. 2d. and £15 19s. 10d. respectively. The shareholders at a recent meeting adopted the former proposal; and the disbursement will shortly take place.

Opposition to the Midland Water Scheme.—Sir J. C. N. Alleyne has declared himself an opponent to the taking of the Peak waters by Sheffield, Leicester, or Derby, as is proposed. Sir John is a member of the Derbyshire County Council; and he recently addressed a meeting of the Belper Natural History and Philosophical Society for the purpose of stating the reasons why he felt it necessary to oppose the proposals of the Leicester Town Council. He contended that the effect of the Leicester Bill would be to empower the Corporation to rob Derbyshire of 50 million gallons of water per day, and 31 acres of collecting-ground. He asked whether Leicester would lay compensating pipes along the hillsides to recompense the springs and wells which would be drained. All places along the route would be affected if the head waters were removed. Leicester should be called upon to show that it had not a supply of water in its own county. In a dry season the mills at Cromford, Belper, and Darley could not be worked by water. In the summer, 70 million gallons of water per day in the Derwent was considered an excessive estimate; yet Leicester wanted to take 50 million gallons per day.

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The Award in the Malvern Arbitration.—Mr. J. Shiress Will, Q.C., the Umpire in the arbitration in connection with the acquisition by the Malvern District Council of the undertaking of the Malvern Link Gas Company, the proceedings in which were reported in the "JOURNAL" for the 8th ult. (p. 1042), has made his award. The amount the Council will have to pay, if the arbitration stands, is £22,100, to which must be added the whole of the costs. It may be remembered that an important point of law was raised by Mr. Balfour Browne, on behalf of the Council, in the course of the proceedings; and if this should be decided in their favour, the value of the works to the ratepayers would be very much less. The Council have decided to appeal on the point of law. The Company claimed £27,000; the Council's estimate of the value was £18,462.

East London Water Supply.—The extension of water supply in East London began on the 22nd ult. in the following localities: Walthamstow, Leyton, Whitechapel, St. George's-in-the-East, City of London, and part of Wapping. On the 26th, it was extended in East Ham, Bethnal Green, Shoreditch, North Woolwich, and Ilford; on the 28th, to West Ham and Hackney; on the 30th, to Wanstead, Woodford, Mile End, and part of Bow; on Saturday last, Loughton, Chingford, Chigwell, Buckhurst Hill, and the rest of Limehouse, and Poplar. At the Hackney Town Hall, last Tuesday, the first meeting was held of the Committee of Local Authorities of East London, appointed by the conference of Sept. 15 on the East London Water Question—Mr. T. Hosgood presiding. Mr. G. Chambers moved—"That, in the opinion of this Committee, it is desirable that the area now being supplied with water by the eight Metropolitan Water Companies should be supplied with water by one central authority," and the motion was adopted unanimously. Mr. Valentine moved—"That it is desirable that such central authority should be the London County Council, with representatives on the Water Committee from the districts outside London." This motion also was carried.

Messrs. Crossley Bros., Limited, have obtained a contract for supplying to the London County Council eight gas-engines for the Lots Road sewage-pumping station. There were six tenders, that of Messrs. Crossley being the highest; but its acceptance was recommended by the Main Drainage Committee after considering a report by the Chief Engineer (Sir A. Binnie).

With reference to the intimation contained in the "JOURNAL" last week that Mr. J. W. C. Holmes is retiring from the Huddersfield firm on account of ill-health, and that the business will henceforth be carried on by Mr. Percy F. Holmes, we are informed that Mr. E. D. Holmes, who has been connected with the firm for some years, will be associated with his brother, and that the undertaking will be conducted by them under the present style.

As mentioned in the report which appears in another column, the Gas Committee of the Birmingham Corporation have accepted the tender of Messrs. C. & W. Walker, of Donnington, Salop, for the purifiers—twelve in number, each 40 feet long and 35 feet wide—in connection with the extensions at the Saltley Gas-Works; the whole being in accordance with the plans and specification prepared by the Engineer, Mr. Henry Hack. This is the third lot of large purifiers the firm have carried out at these works since the beginning of 1896.

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WANTED, on Dec. 31, 1898, a Young MAN capable of laying Mains and Services for a Water Company. Salary, 25s. a week. Good References required.
Apply to A. HAROLD RUSTON, Secretary, Newmarket Water-Works Company, Ltd., NEWMARKET.

METER Inspector and Collector wanted by a Gas Company in the South of England. Practical experience in Ordinary and Prepayment Meters necessary. Permanency.
Apply, with full Particulars, to No. 3179, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Draughtsman, by a Leeds Firm of Gas-Works Contractors. Must have a knowledge of Conveying Machinery and Inclined Retorts.
Apply, stating Age, Experience, and Salary required (in confidence), to No. 3167, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ROTHERHAM CORPORATION GAS-WORKS.

WANTED, a good General Foreman.
Must be a First-class Carbonizer, used to Regenerative Furnaces and Inclined Retorts, and the control of Workmen. Wages £2 per week, and Eight-Hour Shifts.
Applications, stating Age and Experience, together with Testimonials, to be sent to the undersigned on or before Dec. 13.
FRANK A. WINSTANLEY,
Engineer and Manager.

DISTRIBUTING FOREMAN.

WANTED, immediately, by a Suburban Gas Company, a GENERAL FOREMAN to take charge, under the Engineer, of the Distributing Department. Must be of good address, capable of controlling Men, have had good experience in Main and Service Work, fixing and testing Meters, Internal Fitting Work, and capable of conferring with and advising Consumers.
Applications, in own handwriting, with *copies* of not more than three recent Testimonials, stating Salary required, Qualifications, &c., to No. 3170, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AUTOMATIC GAS LIGHTING.

GAS Engineer invites Price Lists and PARTICULARS OF APPLIANCES for above from Patentees, Manufacturers, &c.
Address No. 3178, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—10 Tons of Hydrocarbon.
Apply STORE-KEEPER, L. & Y. Ry. Company, Osborne Street, MANCHESTER.

FOR SALE—A Sulphate of Ammonia Plant, suitable for Works carbonizing 4000 Tons of Coal per annum. Built by Abbott & Co., London.
Apply to the CLIFTON AND KERSLEY COAL COMPANY, LIMITED, Clifton, MANCHESTER.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of FIRE-CLAY GOODS.
Specification, Quantities, and Form of Tender may be obtained on application to Mr. W. Whatmough, Gas Manager.
Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.
Tenders, endorsed "Fire-Clay Goods," to be sent to me not later than Tuesday, Dec. 13, 1898.
By order,
J. H. BALDWICK,
Town Clerk.
Municipal Buildings,
Heywood, Nov. 17, 1898.

FOR SALE BY PRIVATE CONTRACT.

SHARES in various sound Gas and Water Undertakings to yield Investors from 4 per cent. to 5 per cent.
Mr. MARTIN, 117, Broomwood Road, CLAPHAM JUNCTION, S.W.

RAMSGATE CORPORATION.
(GAS DEPARTMENT.)

TENDERS invited for 2500 (12-feet lengths) 6-inch GAS-PIPES, 500 4-inch GAS-PIPES, together with about 5 Tons of BENDS, BRANCHES, &c.
(WATER DEPARTMENT.)
Also for 375 4-inch and 125 3-inch WATER-PIPES, in 12-feet lengths; and about 4 Tons of TEES, BENDS, &c.
Tenders to be sent in addressed to the Chairman of the Gas and Water Committee, Hardres Street, not later than Dec. 31, endorsed "Tender for Pipes."
The Committee do not bind themselves to accept the lowest or any Tender.
Specification and full Particulars on application to
WILLIAM A. VALON,
Engineer.

RAMSGATE CORPORATION.
(WATER DEPARTMENT.)

TENDERS invited for Compound Con-DENSING BEAM-ENGINE, working up to 100 Brake Horse Power, delivered and fixed at the Whitehall Pumping-Station.
Tenders to be sent in addressed to the Chairman of the Gas and Water Committee, Hardres Street, not later than Dec. 31, endorsed "Tender for Compound Engine."
The Committee do not bind themselves to accept the lowest or any Tender.
Plans, Specifications, and full Particulars on application to
WILLIAM A. VALON,
Engineer.

SHOTLEY BRIDGE AND CONSETT DISTRICT GAS COMPANY.

TENDERS FOR TAR.

THE Directors of this Company invite TENDERS for the purchase of the TAR to be produced at their Works during the Year 1899.
Quantity, about 60,000 Gallons.
The Contractor to find his own Barrels or Casks, and to accept delivery at Blackhill Station.
Tenders to be sent in not later than Thursday, Dec. 8, 1898, addressed to the undersigned.
M. RICHLEY,
Secretary.
Office: Front Street,
Shotley Bridge, Nov. 28, 1898.

WALLASEY URBAN DISTRICT COUNCIL.
(GAS, WATER, AND ELECTRICITY DEPARTMENT).

THE Wallasey Urban District Council are prepared to receive TENDERS for the supply and delivery of WASTE-WATER METERS and FITTINGS.
Full Particulars may be obtained on application to the Engineer, at his Office at the Gas and Water Works, Great Float, near Birkenhead.
Tenders (on the Form provided for the purpose), addressed to me as below, and endorsed "Water-Works Committee, Tender for Waste-Water Meters, &c.," to be delivered, per post, not later than Thursday, the 15th inst.; and any Tenders arriving after that date will not be considered.
By order,
H. W. COOK,
Clerk to the Council.
Public Offices, Egremont,
Cheshire, Dec. 1, 1898.

CORPORATION OF LEICESTER.

CAST-IRON PIPES.

THE Gas and Electric Lighting Com-mittee of the above Corporation are prepared to receive TENDERS for the supply and delivery of the necessary CAST-IRON PIPES and CONNECTIONS, from 2 inches to 24 inches in diameter, required during the Twelve Months ending the 31st of December, 1899.
Specification and Form of Tender to be obtained from the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Cast-Iron Pipes, &c.," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, Dec. 10, 1898.
The Committee do not bind themselves to accept the lowest or any Tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Offices: Millstone Lane,
Leicester, Dec. 2, 1898.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS in respect both to the Four-and-a-Half per Cent. and Three per Cent. DEBENTURE STOCKS WILL BE CLOSED on the 15th of December inst., and RE-OPENED on the 2nd of January, 1899.
By order,
I. A. CROOKENDEN,
Secretary.
St. Helen's Place,
Bishopsgate Street, E.C.,
Dec. 3, 1898.

COUNTY BOROUGH OF STOCKPORT.

(Gas and Electricity Department.)

PURIFIERS, IRON ROOF, AND IRON COLUMNS.

THE Gas and Electricity Committee are prepared to receive TENDERS for the supply and erection complete of Four PURIFIERS, IRON ROOF, and COLUMNS required for an intended Building to be erected at their Portwood Gas-Works.

Plans, with Specifications and full Particulars, can be obtained on application to the Engineer, Mr. S. Meunier, on payment of One Guinea, which is not returnable.

Tenders, endorsed "Ironwork," must be addressed to the Chairman of the Gas and Electricity Department, Stockport, on or before Twelve o'clock noon on Thursday, Dec. 15 next ensuing.

The Resolution of the Council that Contractors will be expected to pay the Standard Rate of Wages paid in the district will apply to this Contract.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
WALTER HYDE,
Town Clerk.

Stockport, Dec. 3, 1898.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK, WILL BE CLOSED at Ten o'clock forenoon, on Friday, the 9th inst., for the Half Year ending the 31st of December, 1898, and will be RE-OPENED on Friday, the 16th inst.

The Interest for the Half Year will be payable on the 1st of January next to the Proprietors registered on the closing of the Books.

By order of the Board,
JAMES RANDALL,
Secretary.

Gas Offices: Willoughby Lane,
Tottenham, Dec. 2, 1898.

LAMBETH WATER-WORKS COMPANY.

NOTICE is Hereby Given, that it is the intention of the Company to SELL BY TENDER £100,000 THREE PER CENT. DEBENTURE STOCK, redeemable at par by the Company on Six Months' Notice at any time after the expiration of 25 Years from the date of issue.

Particulars, Conditions of Sale, and Forms of Tender may be obtained at the Company's Office, Brixton Hill, S.W.

Sealed Tenders are to be delivered at the said Office not later than Twelve o'clock noon, on Monday, the 19th of December, 1898.

By order,
H. WILKINS,
Secretary.

Brixton Hill, S.W.,
Nov. 17, 1898.

EAST LONDON WATER-WORKS COMPANY.

ISSUE OF £150,000 THREE PER CENT. DEBENTURE STOCK.

MINIMUM PRICE, PAR.

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the ABOVE ISSUE (created under the East London Water-Works Act of 1897), bearing Interest at 3 per cent. per annum, less income-tax, and redeemable after the expiration of 25 Years from the date of Issue, subject to Six Months' Notice being given by the Company.

Tenders must be delivered at the Company's Offices, St. Helen's Place, Bishopsgate Street, E.C., not later than Eleven a.m., on Monday, Dec. 12 ensuing.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Offices, or will be forwarded on application.

By order of the Court of Directors,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place,
Bishopsgate Street, E.C.,
Nov. 15, 1898.

STAINES RESERVOIRS JOINT COMMITTEE.

INCORPORATED BY ACT OF PARLIAMENT, 59 AND 60 VIC., CAP. 241.

ISSUE OF £500,000 £3 PER CENT. DEBENTURE STOCK.

MINIMUM PRICE, PAR.

Payment of Interest guaranteed by the three following Companies:—
The West Middlesex Water-Works Company,
The Grand Junction Water-Works Company, and
The New River Company, jointly and severally.

NOTICE is Hereby Given, that the Joint Committee are prepared to receive TENDERS for the above amount, being a further portion of the DEBENTURE STOCK created by the above Act and by the Act of 1898, bearing Interest at £3 per cent. per annum, payable Half Yearly, and redeemable after the expiration of 25 Years from the date of issue, subject to Six Months' Notice being given by the Committee.

The Staines Reservoirs Act, 1898, authorizes Trustees to invest Trust Funds in this Stock.

Tenders must be delivered at the Office of the Committee, No. 19, Marylebone Road, N.W., not later than Two o'clock p.m., on Wednesday, the 21st of December next.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Office, or will be forwarded on application; also of Messrs. Hollams, Sons, Coward, and Hawksley, Solicitors, 30, Mincing Lane, E.C.; and of Messrs. Prescott, Dimsdale, and Co., Limited, Bankers, 50, Cornhill, E.C.

By order of the Joint Committee,
F. H. WYBROO,
Secretary.

Office of the Committee:
19, Marylebone Road, London, N.W.,
Nov. 23, 1898.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK AND BONDS, WILL BE CLOSED at One o'clock p.m. on Saturday, the 10th prox., for the Half Year ending on the 31st prox., and will be RE-OPENED on the Morning of Monday, the 12th prox.

The Interest for the Half Year will be payable on the 2nd of January next to the Proprietors registered on the closing of the Books.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Nov. 29, 1898.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

NORTH MIDDLESEX GAS COMPANY.

£00 £10 ORDINARY SHARES.

Ranking for a Standard Dividend of 7 per cent., subject to the Sliding-Scale—the last Dividend on similar Shares having been at this rate.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 13, at Two o'clock, in Lots.

Particulars of Messrs. MERRIMAN, PIKE, AND MERRIMAN, Solicitors, 25, AUSTIN FRIARS, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of Trustees and other Owners.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 13, at Two o'clock, in Lots—

BOURNEMOUTH GAS AND WATER COMPANY.

131 £10 "B" SHARES (fully paid), ranking for a Maximum Dividend of 7 per cent.

MAIDENHEAD GAS COMPANY.

53 £12 "A" SHARES (fully paid) and 33 £10 "B" SHARES (fully paid), paying Dividends of 10 and 7 per cent. respectively.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

ENRICH YOUR GAS
WITH
CHEAP BENZOL.

AT to-day's Price of Benzol, Illuminating POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.

Apply to SADLER & CO., MIDDLESBROUGH.

ARMSTRONG'S
PATENT
CANDLE SAFETY LAMPS

Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.

48, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

JAMES OAKES & CO.
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

THE Acetylene Illuminating Company, Limited, 63, Queen Victoria Street, London, E.C., GIVE NOTICE that they hold the BRITISH PATENT RIGHTS for the MANUFACTURE OF CALCIUM CARBIDE by means of the electric furnace, that they are bringing an action against the Midland Acetylene (Parent) Syndicate, Limited, to restrain them from so manufacturing that product, and that they intend in the future to bring actions against all infringers of these Patents and all purchasers or users of Carbide of Calcium made in infringement of the same.

NOTICE.

THE Acetylene Illuminating Company, Limited, having published and issued an advertisement or circular claiming that they hold the British Patents for the Manufacture of Calcium Carbide by means of the Electric Furnace, we guarantee to indemnify anyone who buys Carbide from us against any claim by "The Acetylene Illuminating Company, Limited," or anyone else.

READ HOLLIDAY AND SONS, LIMITED, Acetylene Gas Engineers and Carbide of Calcium Manufacturers, HUDDERSFIELD.

NOTICE.

THE Acetylene Illuminating Company, Limited, having published and issued an advertisement or circular claiming that they hold the British Patents for the Manufacture of Calcium Carbide by means of the Electric Furnace, we guarantee to indemnify anyone who buys Carbide from us against any claim by "The Acetylene Illuminating Company, Limited," or anyone else.

TINKER AND HOLLIDAY, LIMITED, Carbide of Calcium Manufacturers, HAZELHEAD, SHEFFIELD.

THE
ACETYLENE ILLUMINATING COMPANY, LTD.,
Manufacturers of Carbide of Calcium,
63, QUEEN VICTORIA STREET, LONDON, E.C.,
and FOYERS, SCOTLAND.

NOTICE.

MESSRS. Read Holliday & Sons, Ltd., of Huddersfield, and Messrs. Tinker, Holliday, & Co., Limited, of Hazelhead, Sheffield, having advertised that they are Manufacturers of Carbide of Calcium, and having guaranteed to indemnify anyone who buys Carbide from them, against any claim by the Acetylene Illuminating Company, Limited, Notice is Hereby Given by the Acetylene Illuminating Company, Limited, that they have been unable to secure any evidence, and do not believe, that either of the said Firms is, a Manufacturer of Carbide of Calcium.

The Acetylene Illuminating Company, Limited, for over two years, have been supplying Carbide to Messrs. Read Holliday & Sons. This Firm has, since advertising as above mentioned, ordered a further supply, which order the Acetylene Illuminating Company, Limited, have declined to execute in view of such advertisement.

On the Acetylene Illuminating Company, Limited, securing evidence that either of the above Firms, or any other Person or Firms are manufacturing or importing Carbide of Calcium, they will bring an action for Infringement of their Patent Rights.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·4 candles.
Coke	68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,

THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON NEWCASTLE."

HOLMSIDE

GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	$16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality)	$13\frac{3}{4}$ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR

PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

WATERBLEAN PAINT

TELEGRAMS: "EVESON, BIRMINGHAM."

EVESON FOR CANNEL

TUBES AND FITTINGS

ALL KINDS

WRITE FOR PRICES

STAFFORDSHIRE TUBE Co., BIRMINGHAM.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER." Telephone 1806.

WELDON MUD

FOR

GAS PURIFICATION,

For use in the

RECOVERY OF SULPHUR,

ALSO

Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:

GAS DESULPHURIZATION CO.,

— *LIMITED,* —

1, FENCHURCH AVENUE, LONDON, E.C.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895,*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

INCANDESCENT GAS LIGHTING.

Incandescent Burners from **5/6 per doz.**

Specially annealed best Fireproof Glass Chimneys (equal to the Jena.) 1/4 per Doz.

All other Incandescent Fittings at greatly reduced Prices.

Best "Comet" Bulbs, 3s. per Dozen.

Write for Illustrated Price Lists.

WHOLESALE FITTINGS COMPANY,
80, COMMERCIAL ROAD, LONDON, E.

INCANDESCENT GAS LIGHTING

Has now gained a complete and final **Victory** over its last and greatest Enemy

VIBRATION,

BY MEANS OF

CLAY'S PATENT

SHOCK-PROOF

Incandescent Burner Fittings

Of which full Particulars may be had from

CLAY & WALMSLEY,

BOLTON, ENGLAND.

Telegrams: "CLAYS, BOLTON."

See "JOURNAL OF GAS LIGHTING," July 7, 1896, p. 19, and Dec. 21, 1897, p. 1365.

London Representatives: H. Greene & Sons, Ltd., 1.3 & 155, Cannon Street, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.
London Office: R. Cull, 84, Old Broad St., E.C.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY
RAVENSTHORPE, NEAR DEWSBURY.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
THE GRASSMOOR CO., LD.
CHESTERFIELD.

JAMES MILNE & SON, LTD.,
GAS ENGINEERS,
MILTON HOUSE WORKS, EDINBURGH.
LONDON. —— LEEDS. —— GLASGOW.

THE WIGAN COAL & IRON CO., LIMTD.,
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.
Midland District Office: PRINCE'S CHAMBERS, 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.
London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.
Telegraphic Address: "PARKER, LONDON."

WORKMANSHIP and MATERIALS OF THE HIGHEST QUALITY.
PECKETT'S LOCOMOTIVES
Built to any Specification or Gauge.
PECKETT & SONS, Atlas Locomotive Works, **BRISTOL.**

LONDON OFFICE
60 QUEEN VICTORIA ST. E.C.
TELEGRAPHIC ADDRESSES
"DRAKESON HALIFAX."
"ECLAIRAGE LONDON."
TELEPHONE No 43
"HALIFAX EXCHANGE"
GAS ENGINEERS.
CONTRACTORS.
IRONFOUNDERS.
JONAS DRAKE & SON
SOLE AGENTS FOR
HISLOP'S
PATENT REGENERATIVE FURNACES
—FOR—
ENGLAND, WALES & ABROAD.
RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES.
RESULTS GUARANTEED.
OVENDEN HALIFAX
RETORT SETTERS.
FURNACE BUILDERS.
ETC. ETC.
Designs and Estimates on Application.
GASEOUS FIRING A SPECIALTY.

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

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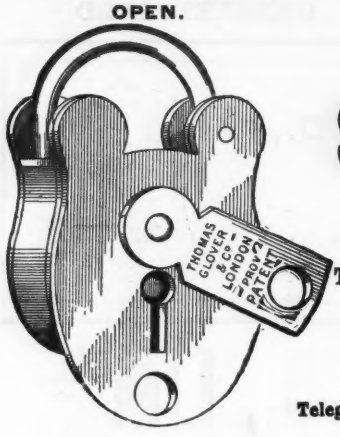

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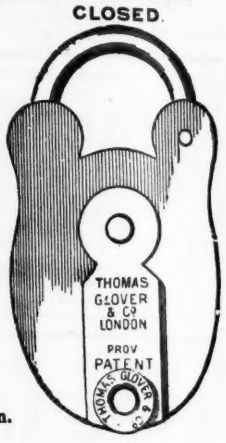

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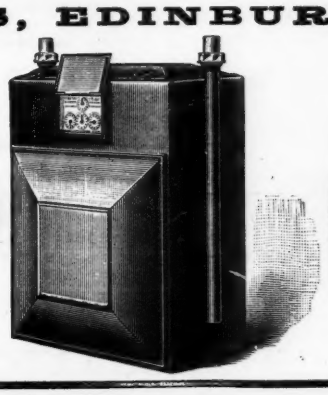

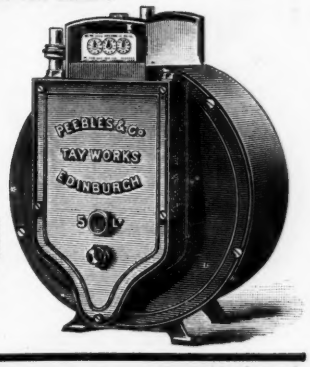

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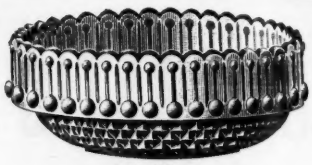

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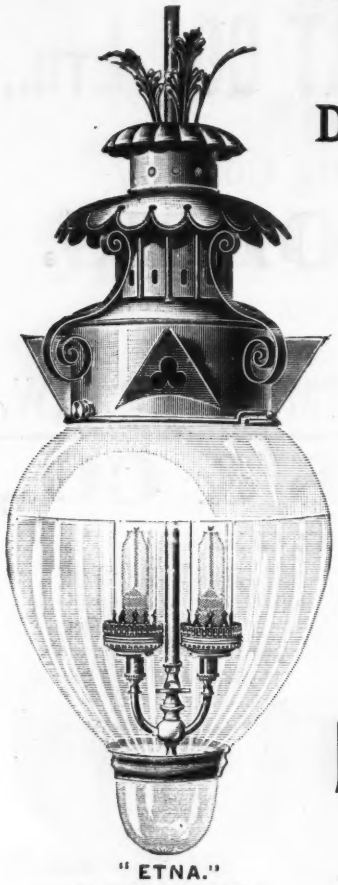

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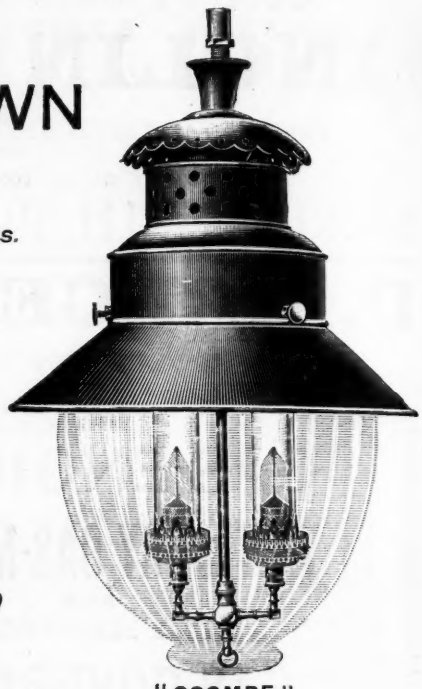

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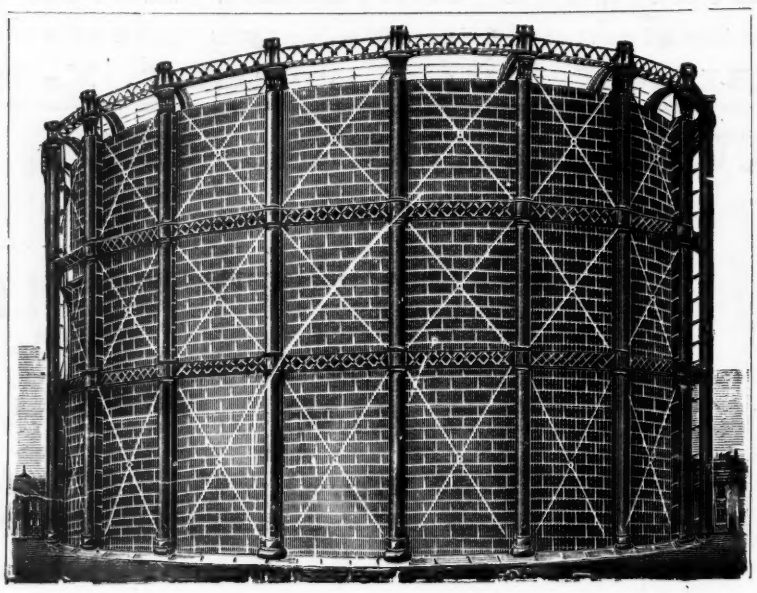

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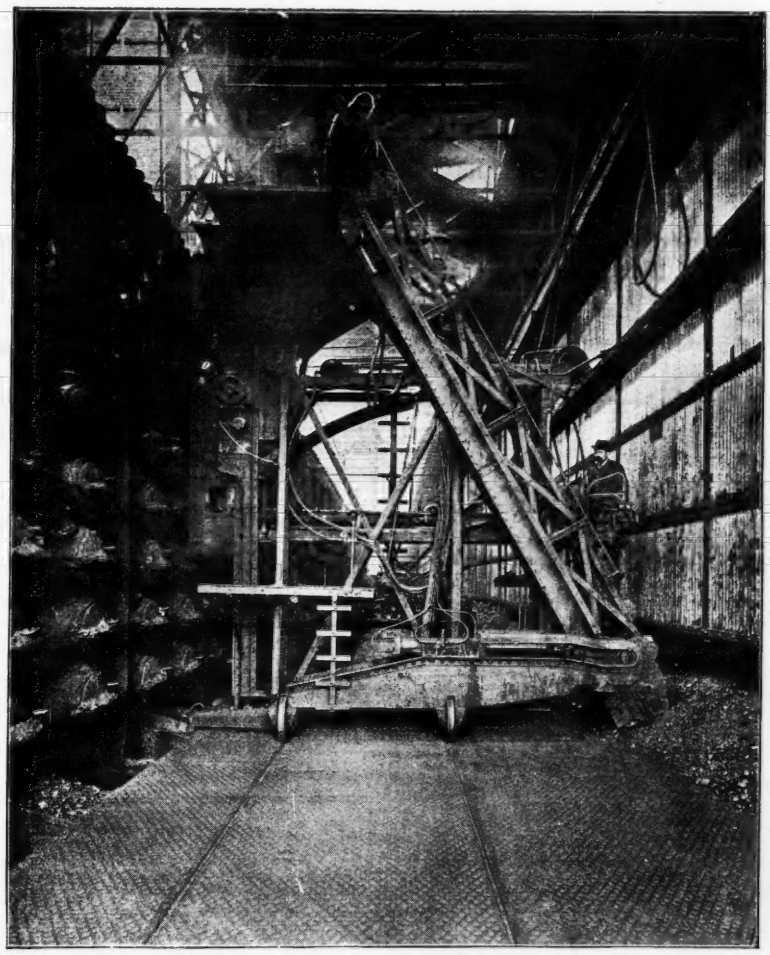

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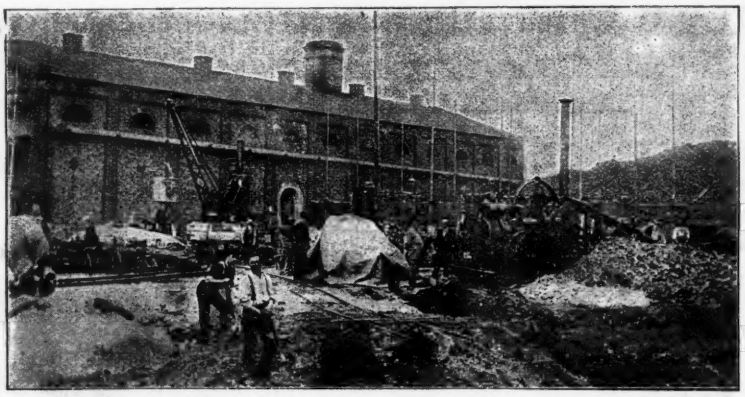

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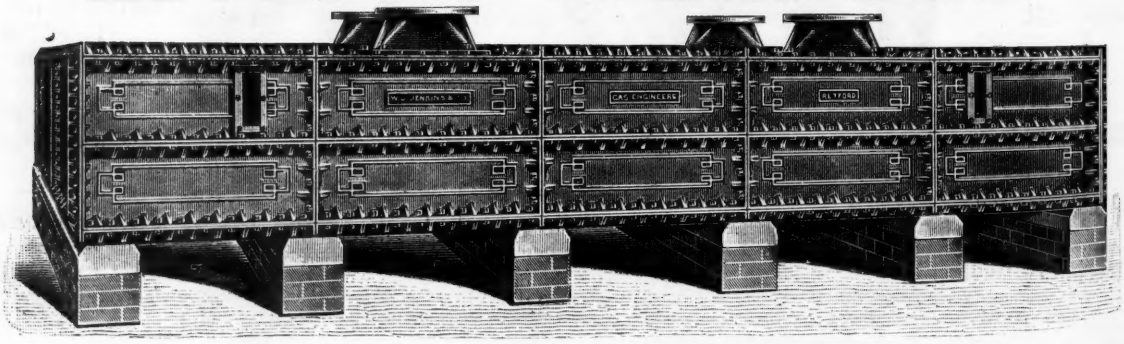

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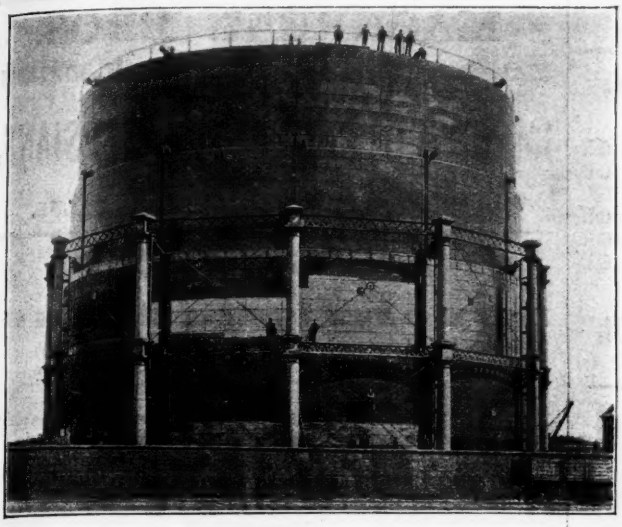

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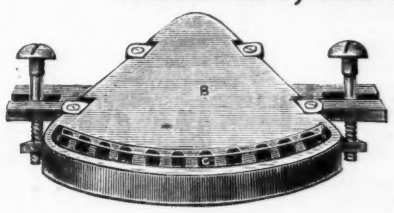

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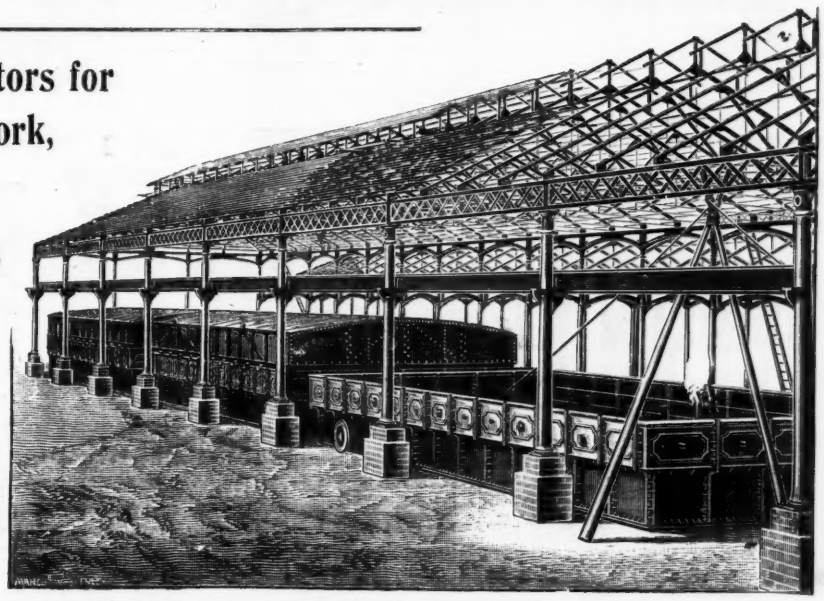

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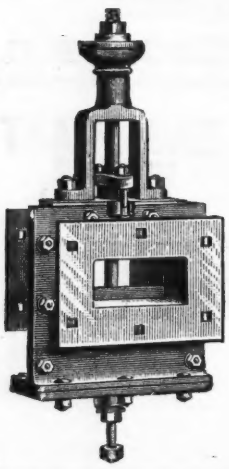

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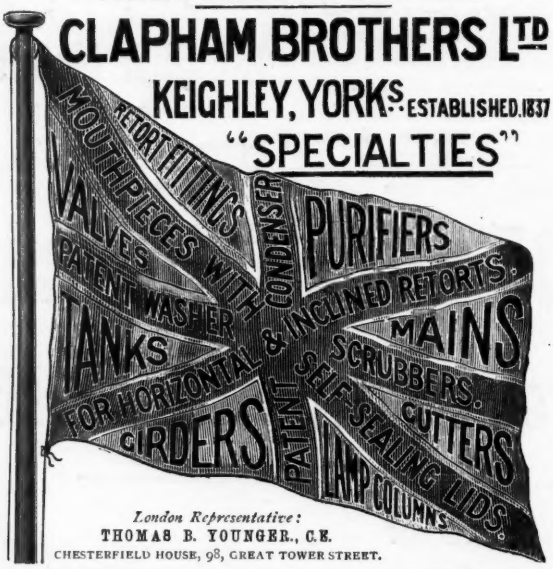

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